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PERSONAL HYGIENE APPLIED

By
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Columbia University

SIXTH EDITION, REVISED AND RESET

PHILADELPHIA AND LONDON
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PHILADELPHIA

TO MY WIFE

Team Mate in the Game

To Live Most and to Serve Best

PREFACE TO SIXTH EDITION

In this, the Sixth Edition, a careful and thorough revision is attempted. The literature has been examined and every effort made to present adequately the advances in scientific fields that relate to health.

The revision departs from the previous organization of the book in three ways. Beginning with Chapter VI, each chapter starts with a discussion of anatomical and physiological backgrounds. The author has felt that persons could learn "to live most" without first learning the detailed anatomy and physiology so often taught as hygiene, in very much the same way that an amateur can learn to take excellent pictures with a camera without also learning the detailed facts of optical science. However, in the lecture room, it has been the author's practice to present some facts of structure and function; and this inclusion of similar material in the text is in harmony with common practice in the field.

The second departure consists in removing the discussion of autacoids from the chapter on circulation and inserting a new chapter on the Endocrine System. This new chapter is very brief not because these glands are unimportant but because so little is known of their hygiene. Extended discussion of their physiology and pathology could have been given, but these interesting data are not hygiene.

The third departure is the removal from Chapter XIV, Prevention of Specific Disease, the detailed data on communicable disease control and including these in an appendix. Many instructors use this material only as reference. In the appendix, it will serve this purpose, and the main argument of disease prevention will not be confused by the extended data of the Committee Report.

Also in the appendix is given a list of topics for Term Reports that the author has used for some years, with modification from time to time. The list is intended to be suggestive.

Finally in the appendix is a sample true-false test based upon the Preface and the first five chapters. The test is standardized. It has been used with over 7000 students.

This book has continued to receive the warm approval of students and teachers of hygiene. An author may not interpret correctly the reasons for approval or disapproval, but certainly in the rapidly changing field of health education it is imperative that a book on personal hygiene should reflect the most recent knowledge about how to live.

It will be noted that the underlying philosophy of the book, expressed in the words, "to live most and to serve best," remains unchanged. New facts will be discovered from time to time and on the basis of acceptable evidence, old practices will be altered and new ones adopted. Constant changes should be expected therefore in the factual elements that make up the scientific guides for living but not in the fundamental approach to the problem. Regardless of the changing items of procedure, one's purpose to find the facts of life, and to live in accord with them, may remain unaltered. This is the open mind at its best.

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PREFACE

THE aim of this book is to improve the quality of human life. It is evident from the title that this aim seeks its goal by means of hygiene, but it should be clear also that no mere recitation of informational hygiene can be justified if the aim is to be achieved. To improve human living one must not only set forth the rules of health but also one must bring them in contact with that deep and ever-flowing source of human action where ideals, ambitions, attitudes, prejudices, hopes, and aspirations are born. To find the scientific rule for health is not more important than to touch the mainspring to action that will give life and meaning to the rule discovered.

The interest in health today is very great. In proportion to its importance and in relation to past appreciations health is not overvalued. But we should be careful not to appraise it too highly as an isolated value. Oftentimes we make it too prominent as an end; then it protrudes too much and mars the whole of life. To recognize that it is of meaning and significance only in its relation to other values is tremendously important today. Three of the finest things in life—heroism, creative work, and child-bearing—are often injurious to health. To avoid battle for the right, or to forsake productive work, or to miss parenthood because of the toll in health that these things take twists and warps life and mixes values woefully. The sacrifice of health in personal, selfish, and unsocial ways can never receive sanction. Contrariwise, the scars from the "strenuous and dangerous activities of helping to create" a new rule of right and justice, "a new harmony or a new child" are symbols of the divine. Health is more than perfect digestion, more than perfect bodily functions. To find what more it is constitutes an important part of the problems of hygiene.

The first five chapters consider the various aspects of this problem—the meaning of health in terms of life. The treatment is not complete. No one recognizes their inadequacy more than the author. To write a philosophy of life in terms of aims and goals, and to tie such philosophy up with the immediate, thrusting appeals of the moment, as the problems in human living are revealed, is more than this can claim. Rather, I must be content to sketch certain points of view, to hazard a hope here and there, to suggest ideal guides, to inveigh against palpably false ones, and everywhere to emphasize the identity of hygiene with life and the necessity for knowledge to flow into action. Therefore, to insist that hygiene can never be, for life purposes, an academic subject to be learned merely, and to hold with real conviction that it is useful only as it is lived, have been controlling guides here.

The remaining chapters consider in a systematic way hygiene from its scientific side. The finest ideals in the world cannot prevail against an infected lung; science with her torch will always be needed to illumine the processes of life. For discussion purposes, however, the treatment has been systematic. This has its advantages, obviously. Its disadvantages, while indirect, are no less real. Life does not manifest itself in circulatory, nor in muscular, nor in nervous pathways alone. The unity of mind and body preclude that. It is always vain to force the living into set molds. "All the molds crack. They are too narrow, above all, too rigid, for what we try to put into them." To preserve the unity and harmony of life has been attempted throughout. Nevertheless, the disadvantage of such organization remains unless the reader sees beyond the boundary lines.

The book aims to be scientific and accurate according to the latest information available. It has tried to avoid propaganda, to convert, or to get people to follow a scheme. It has aimed to present facts in human experience, to establish science and intelligence as guides, and to replace superstition, cults, fads, tradition, and certain instinctive

responses with truer counsellors. In this respect it is expressing a dominant mood in education today and takes its position courageously, asking that truth shall decide, let the results seem what they may.

This book is planned for college students. Not only to students of health does it seek to present its case but also to students of sociology, philosophy, and education. There are reciprocal values to be found in the touch with other fields. Hygiene has been in need of a sociologic point of view, a philosophic approach, and educational standards that would stimulate careful instruction and would deserve credit in university and college curricula. Education in special fields for other reasons needs to consider the problem of human health and biologic problems in living. "Health in Education and Education in Health" is a significant slogan.

It is hoped that this book may not be constricted to the school or college field. Physicians, teachers, nurses, social workers require a book which they may recommend to parents or patients in need of guidance for living. The emphasis on the mental and social aspects of health, as well as the physical, suggests its usefulness in facilitating social adjustments.

Health results from living in the proper way. It flows from life as a by-product of actions, responses, or conditions that are wholesome. So that whether in college or out, the problems of human living remain essentially the same: to adjust a rather primitive, biologic organism to a complex civilized society, and to shape society to provide for man's essential biologic and social needs. The view held for this problem of human adjustment is that one should first face the problems and then try to meet them squarely and honestly, paying whatever price is required. Therefore, I have written vigorously against the bankrupt methods that aim "to beat the game," to find a short cut, or to seek a royal road.

I am glad to acknowledge my indebtedness to students and colleagues for help in the preparation of this book.

The former have been stimulating questioners; the latter, the kindest and most helpful of critics. I wish to acknowledge here my indebtedness to Professor H. C. Pearson, who has given many helpful suggestions, to Professors M. S. Rose and W. H. Eddy, who have proposed many good points in the chapter on nutrition, to Professor M. A. Bigelow and Dr. E. E. Foster, who have read the entire manuscript, giving a keen criticism of form and content, I am under deep obligation.

In particular, at this time and place, I desire to thank Professor William H. Kilpatrick who has guided me through two writings of the first five chapters. For his invaluable criticism I am greatly indebted.

Citations and quotations from numerous sources are indicated in the footnotes of the text. These references are suggestive of helpful material for further study along the lines indicated. For permission to quote I am greatly indebted to the publishers concerned. I wish to take this opportunity to acknowledge this permission granted and to express my appreciation of the courtesy extended by Abingdon Press, D. Appleton & Co., P. Blakiston's Son & Co., Curtis Brown, Ltd., The Century Co., Dodd, Mead & Co., Funk & Wagnalls, Henry Holt & Co., Houghton Mifflin & Co., J. B. Lippincott Co., John W. Luce & Co., The Macmillan Co., Princeton University Press, W. B. Saunders Co., Chas. Scribner's Sons, Seeley, Service & Co., Teachers College, John Wiley & Sons, Williams & Wilkins Co., and William Wood & Co.

What I owe to others in these matters is very large. However, the errors, where they occur, are mine.

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Jesse Feiring Williams.

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A Definition of Health.—Health is defined in dictionary and encyclopedia as a condition of physical soundness, or as a condition in which the organism discharges its functions efficiently. The word "health" is derived from the Old English word *hoelth*, the condition of being safe and sound. Today, in the minds of most people, health has this historic meaning and is considered merely as freedom from disease.

There is in this definition of health, as freedom from disease, no appreciation of the varying degrees of healthfulness among those usually classed as well, and no understanding of the heights that could be attained in human health and living if all the available means for improving health were employed. One need be only a casual observer to recognize that a great number of people are living below their best level of attainment. Many persons believe themselves healthy because they are not sick in bed, and this lack of appreciation of health as a quality of life prevents the realization of a greatly superior type of life. It is, perhaps, impossible to say how far any individual could progress in achieving a finer and higher level of living.

It is not too much to say, however, that health, as an idea, should imply more than freedom from disease. Such broadening of the idea would bring not only increased health values but also desirable social values.

It is of value to think of health as that condition of the individual that makes possible the highest enjoyment of life, the greatest constructive work, and that shows itself in the best service to the world. It involves keeping the body and mind at the highest levels, living at one's best and not being satisfied with mere absence from the hospital and sick room. This concept of health, moreover, parts company with that idea of health which takes it as an end of life. It refuses to consider as healthy the individual who employs a wonderful physical body for purely selfish and socially undesirable ends.

Such a doctrine as "health for health's sake" is entirely unsatisfactory. Health is not an end in itself except for the individual sick in bed, and then he desires only to free himself from his disease and "to get well."[1] "Health for health's sake" is similar to such sayings as "sport for sport's sake" and "art for art's sake." All of these sayings err in making an end of the subject. Sport is of value and should be pursued not for the sake of sport, but for the sake of the training of mind, body, and spirit that comes in contesting in a fine way with one's fellows. Art for the sake of art is often mere superficiality and pose. Art is significant because it portrays in imperishable marble, canvas, music, or written word the finest emotions and thoughts of the human race. Health is of significance in proportion as it denotes a condition of the whole organism, expressing its functions in joyous play, satisfying work, and needed service to others.

Health may be defined, therefore, as *the quality of life that renders the individual fit to live most and to serve best.* The meaning of "to live most and to serve best" cannot be expressed readily. Such things can rarely be defined acceptably in words. To try to do so would be like an

[1] Cabot, R. C.: What Men Live By, Houghton Mifflin Co., Boston, 1914.

attempt to define the term "a good life." Phrases of this kind are to be defined best in terms of personality. The person is the definition of the term whenever the term includes the ideals and aspirations of the human heart. Roosevelt, in *The Strenuous Life*, Gulick, in *The Efficient Life*, and Pastor Wagner, in *The Simple Life*, set standards of living that have health implications, but neither Roosevelt, nor Gulick, nor Wagner defined the life that seemed to them so good. For some "to live most and to serve best" will mean one thing, for others it will mean something else. The world may well hope that more and more men will give to it a human and social meaning, a meaning founded in truth and full of good will to all.

Such a definition of health is broad, but it omits no aspect of life, nor does it include too much. It must be as wide as life, because life is more than digestion, circulation, or nerve response. The physical aspects of health must be interpreted along with the mental and the social. The accumulating evidence from hospitals, social service bureaus, and physicians themselves testifies to this unity of life. The causes of ill health and disease are social and mental as definitely, though not so frequently, as physical causes. Moreover, such definition asks that life be thought of as a whole. Physicians know that they may not speak of the health of the heart and omit other organs from consideration. Viewing life as a whole and not as made up of dissected parts does not mean neglect of the physical. Rather it demands even more clearly that physical vigor be considered fundamental. It only asks that body serve mind and spirit; that the "temple of the soul" be a servant, ready and trained to serve high causes and noble ends.

This broadening of the concept of *health* is justified by life. In the final analysis vigorous body and keen mind are of the highest value in proportion as they serve the highest causes. The test of body and mind is the test not of weight lifting nor of mental gymnastics, but of meeting the crises of life in such a way that a distinct advance has been made either for the individual or for society, or both. The ultimate test is the way in which health is

used; it is the test of conduct, because in this test the physical and the psychical are subjected to the greatest pressure. The highest and best expressions of conduct will be seen when the sound body and the sound mind form the spring from which the action flows. This test is well illustrated by Paton[1] when he says, "Any person who is familiar with the most elementary laws governing human behavior recognizes that the chief test of a sound mind in a sound body is the ability to act in a crisis."

It is helpful to think of health as a quality of life capable of enrichment or deterioration. How fine a quality may be obtained by any individual is unknown, but the degree of health possible with rational knowledge, attention, and effort is considerably higher for every person. *Health as freedom from disease is a standard of mediocrity; health as a quality of life is a standard of inspiration and increasing achievement.*

The Definition Examined.—The definition of health as *the quality of life that renders the individual fit to live most and to serve best* has not enjoyed any wide acceptance. This is true for several reasons. In the first place, people are not well informed of the way in which health is secured and maintained. The home has not been prepared nor inclined to instruct in matters of health and the public schools have only recently been willing to accord hygiene a place in the curriculum. The ignorance of the people in matters of body structure and function has made easy the way for charlatans, quacks, and fakirs by clever advertising to sell their spurious health preparations and prescriptions. Indirectly flowing out of such a situation is a great amount of harm, misinformation, and false guides. One advertisement reads: "Eat what you want, drink manacea water and digest it." It should be noted that even if manacea were efficacious as a digesting water, the teaching of the advertisement is directly contrary to all that is important in personal hygiene. It may never be advisable for any person to eat what he wants; it frequently is very undesirable for him to do so.

[1] From a letter to the *New York Times*, July 10, 1917.

In the second place, this definition of health is not widely accepted because people are so greatly interested in economic and social success that they are unduly willing to sacrifice health for the rewards of work. Many busy men are unwilling to practice hygiene because they say they have no time for it. Professional and business people generally trade too much of vitality for work in careless,

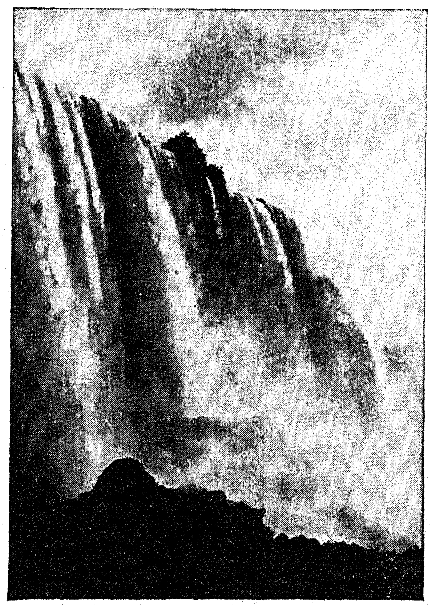


Fig. 1.—The stream of life flows like a mighty river if its sources are abundant. (Courtesy Niagara and Hudson River Corporation.)

inefficient, and wasteful ways. For some, service is such an inspiration that they literally wear themselves out in its pursuit. Service should never mean suicide, although there may be emergencies when service demands the sacrifice of life. One is only fit to serve, even as one is only fit to work, as one keeps oneself prepared to live most and to serve best.

And finally, this definition has no universal appeal be-

cause people lack a philosophy of life that would keep values in proper proportion, that would see straight, and that would link the part to the whole, the personal to the social. The vain effort to buy happiness and to buy recreation is expressive of the same fruitless belief—that personal health can be bought for a price. Public health is purchasable in the sense that sufficient money for adequate sanitation will control the transmission of communicable disease, but personal health cannot be bought by appropriations of money. It can only be possessed by spending time for the care of the body, by selling something of work for recreation, by giving of self in objective, disinterested work for others. It is important to remember that one always pays. To achieve vitality, strength, or personal efficiency costs something that must be taken from work, from instinctive pleasures, or from indulgence of unwholesome habits. There is no way "to beat the game" of life. The stream of life (Fig. 1) will be rich, abundant, lasting in proportion as the sources which constantly nourish it are flowing. And these sources are neither magical nor mysterious. They belong to every man and, briefly, are fresh air, food of the proper kind and amount, wholesome exercise and recreation, proper habits of posture and care of the body, avoidance of alcohol and other poisons, and proper attitude of mind.

What Really Defines Health.—The examination of the definition proposed shows that health cannot be defined academically. No writer on hygiene can do more than indicate desirable guides and the path of his discussion. For most people health is defined by the ideas and ideals of the periods in which they live. The Athenian Greek subjected to the standards of harmony and beauty in Greek life, the Roman citizen in the grasp of militaristic virtues, the ascetic, a pale and pallid product of the monastic system, were all definitions of health in terms of the ideas and ideals of their times and places. Simon Stylites "rotted with the dew" because for him there was no inspiration in health and vitality. The ideas and ideals of the time and place make the definitions of life.

Forces Defining Health Today.—The old ideas have

little sanction today. The scientific and the historic studies have rewritten the story of human life. With new emphases, health has new meanings. The civilized nations are getting away from the ideas of asceticism with its contempt for the physical. We in America have never had the militaristic virtues and the workings of beauty have been too little known. More characteristic of our age and land are the developing social conscience and the increasing sense of social responsibility.[1] This is no passing mood, but a tendency of deeper growth. It is hardly necessary to say that it is filled with rich possibilities for the improvement of life physically, mentally, and socially.

The Influence of Leaders.—This sense of social responsibility is expressing itself through leaders, through organizations, and through the life of the people. It has given us great leaders to define health in terms of living, as it should be defined. The immortal Roosevelt with the out-of-doors upon him, the beloved Burroughs singing his songs to the accompaniment of nature's harmonies, have pointed out the way. Leaders and teachers everywhere are stressing in their lives and in their works social responsibility.

The movement for the conservation of our natural resources is a part of this mood; and the people are saying, "More precious than mines, or rivers, or forests is the health and vitality of the nation."[2] Fisher's "Report on National Vitality,"[3] the revelations of the Selective Service Act,[4] and lessons from the World War in many fields of life have stimulated a growing appreciation of the social significance of ill health, with a better definition resulting. The White House Conference on Child Health and Protection has awakened the imagination of the nation in this respect, and the report of the commission for the study of secondary education of the National Education Association

[1] King, H. C.: Rational Living, The Macmillan Co., New York, 1907, pp. 99–102.

[2] Williams, J. F.: The Conservation of the Nation's Most Valuable Resources, *Educational Review*, November, 1918.

[3] Fisher, I.: Report on National Vitality, Bulletin 30, Government Printing Office, Washington.

[4] Final Report of the Provost Marshal General, Government Printing Office, Washington, 1920.

takes on new meaning. This report,[1] "The Cardinal Principles of Secondary Education," sets forth health as the first of seven objectives for secondary education. Educators have ceased talking of education only in intellectualistic terms and have begun to consider health as a cardinal principle of education.

The Influence of Organizations.—Numerous organizations have sprung into existence in response to this mood of social responsibility for health. Well-established agencies have become increasingly active. Child health has been particularly the concern of many recent movements. The American Physical Education Association, the National Tuberculosis Association, the Joint Committee of the American Medical Association and the National Education Association, and the National Health Council are doing splendid service in propaganda, teaching, and setting of standards, based upon careful study of actual conditions and needs. The older organizations, such as the Children's Bureau of the Department of Labor, the American Red Cross, the National Child Welfare Association, the Life Extension Institute, the Rockefeller Foundation, the Elizabeth McCormick Memorial Fund, and other foundations, are cooperating in many programs for the conservation and improvement of human health. Boards of Health, State Departments of Health, and the United States Public Health Service are raising standards and thus helping to define and give meaning to health.

The Influence of the Life of the People.—But even more powerful than leaders and more extensive than the work of organizations is the influence of society itself as expressed in the actual life of its members. The customs and *mores* of the people are reaching higher levels. Much remains to be done, both in social and in personal effort, but there are, nevertheless, signs of an open trail to better health. The interest in play and recreation (Fig. 2), the out-of-door and camping customs so recently developed, the improvement in dress, and the increasing education of children in

[1] Bulletin No. 35, 1918, Bureau of Education, Department of the Interior, Washington.

hygiene are favorable signs, indeed. The hope that William James[1] expressed some years ago is being fulfilled: "I hope

Fig. 2.—This picture was used in an advertisement by Scripps-Howard Newspapers with the statement: "There are no handsomer, healthier youngsters in the world than those who storm our parks and recreation centers every week-end. Here are no watchers. Here are players. Here are no skinny envious critics. Here are young men and women in the firing line of sport; brown, vigorous, graceful." (Courtesy Scripps-Howard Newspapers.)

that here in America more and more the ideal of the well-trained and vigorous body will be maintained neck and

[1] James, William: Talks to Teachers on Psychology, H. Holt and Co., New York, 1916, p. 205.

neck with that of the well-trained and vigorous mind as the two co-equal halves of the higher education for men and women alike. The strength of the British Empire lies in the strength of character of the individual Englishman, taken all alone by himself, and that strength, I am persuaded, is perennially nourished and kept up by nothing so much as by the national worship, in which all classes meet, of athletic outdoor life and sport."

At one time intentional physical education in America was limited to the stilted and artificial exercise of the German and Swedish systems of gymnastics. These systems never really stirred the spirit of the people. Impregnated with the spirit of the older European institutions, they had little in common with our democracy and the social ideals shaping this nation. A militaristic ideal incorporated in the schools and taught from pulpit and platform might do for us what it has done in Europe in the development of physically strong, docile-minded individuals, but such an aim would run counter to the dominant trait of the American people and could only be achieved by the destruction of democracy and its institutions of freedom. This type of physical education has largely yielded to a better. In its place there has been a phenomenal growth in play and all forms of athletic sports and games. Not all the growth, sad to say, has been wholesome. The athlete has shown too frequently in competition, and especially in the professional field, the absence of those social and moral qualities of paramount importance today.[1]

The absence of the educational point of view in the management of school and college athletics and the emphasis on the professional, spectacular, and exhibitive elements are to be deplored.[2] The activity of alumni primarily interested in "putting the college on the athletic map" has made questionable contributions.

This movement for play and physical activity, wide-

[1] Williams, J. F.: The Education of the Emotions, *Teachers College Record*, May, 1920, pp. 201–216.

[2] Williams, J. F., and Hughes, W. L.: Athletics in Education. W. B. Saunders Co., Philadelphia, 1936.

spread though it is, is not yet everywhere appreciated and respected. In many respects the liberal arts colleges are still breathing the breath of scholasticism in the theory that guides their cultural education.[1] The pressure of studies, the long hours demanded in laboratory and class room leave no choice for the youth to be anything else but anemic and physically weak. There is no comprehensive scheme in the minds of many who lead in educational matters to provide for the broad training of the body that results in characters of force, initiative, and poise. It should be remembered that the "bookworm" who neglects his physical needs is to be condemned equally with the athlete who neglects his mental growth. This neglect of the physical in education not only deprives the youth of opportunity for wholesome growth, but by failure to teach habits of exercise in purposive play and games it lays the foundation for further physical deterioration in adult life through inability to use and to enjoy the physical means of recreation.

To Live Most and to Serve Best.—Health as a quality of life is a challenge to all leaders, to all organizations, to all persons, everywhere, to interpret health in terms of service. The definition given at the beginning of this chapter claims recognition from all those who now seek merely the liberation of man from disease, from inefficiency, from physical weakness, and degeneracy. It asks that personal and social effort to improve health, to eradicate disease, to enrich the processes of life shall be directed constantly toward the purpose of life itself as that may be understood. Not health, but life itself; to live most and to serve best, this is the goal.

Cabot[2] is sounding the same note when he says: "Assuming that in everyone there is an infinite and restless desire to get into the life of the world—to share any and all life that is hot and urgent or cool and clear—we can tackle this infinite task in two ways:

[1] The Rollins College Conference of 1930 and other movements toward a new organization of college curricula are suggestive of a wholesome view that is developing.

[2] Cabot, R. C.: What Men Live By, Houghton Mifflin Co., Boston, 1914, pp. 84, 85.

"By trying to understand the universe in the samples of it which come to our ken, and to draw from these bits of knowledge which typifies and represents the whole. That is science.

"By trying to serve. When we try to serve the world (or to understand it) we touch what is divine. We get our dignity, our courage, our joy in work because of the greatness of the far-off end always in sight, always attainable, never attained. Service is one of the ways by which a tiny insect like one of us can get a purchase on the whole universe. If we find the job where we can be of use, we are hitched to the star of the world, and move with it."

QUESTIONS AND EXERCISES

1. In your own words give a broad definition of health.
2. Why is the doctrine of "health for health's sake" unsatisfactory?
3. State the advantages of considering the health of the whole child.
4. Give reasons why people have not accepted the broader meaning of health.
5. Distinguish between public and personal health.
6. State the function of one's philosophy of life with respect to personal health.
7. Enumerate briefly the sources of good personal health.
8. Show that health is defined in terms of the ideas and ideals of one's time and place of living.
9. List forces which help to define health in America today.
10. Through what channels may social responsibility be expressed?
11. List health agencies in your state and community from which you may expect assistance in the promotion of personal and community health.
12. What national health agencies will furnish helpful materials for your program?
13. Give evidence that people are more interested now than formerly in personal health.
14. List health problems in your community which have not yet been solved.

CHAPTER II

THE HEALTH PROBLEM

The Nation's Vitality.—In the last few years there has been a great deal of interest in the conservation of our national resources. There have been sufficient reasons why we should conserve our national wealth, and a great many people have been interested in conserving forests, water power, and national mines. But there are many sources of national wealth. From a broad standpoint the greatest resource of the nation is the health of the people. The loss that accrues yearly in this part of our wealth is more dangerous and more terrible for the welfare of the nation than the loss that comes in the exploitation of our forests and mines.[1]

In the report on "National Vitality,"[2] elsewhere referred to, preventable sickness and preventable deaths have been estimated. Fisher states that about 42 per cent of the deaths of persons in the United States could be prevented

[1] Williams, J. F.: The Conservation of the Nation's Most Valuable Resources, *Educational Review*, November, 1918.

[2] Fisher, I.: Report on National Vitality, Bulletin No. 30, Government Printing Office, Washington.

or postponed "if the knowledge now existing among well-informed men in the medical profession were actually applied in a reasonable way and to a reasonable extent."

That sickness and death are at times unnecessary and are preventable is well known. This fact, however, is based upon scientific preventive measures and in no way is allied with the mistaken view that ignores matter and

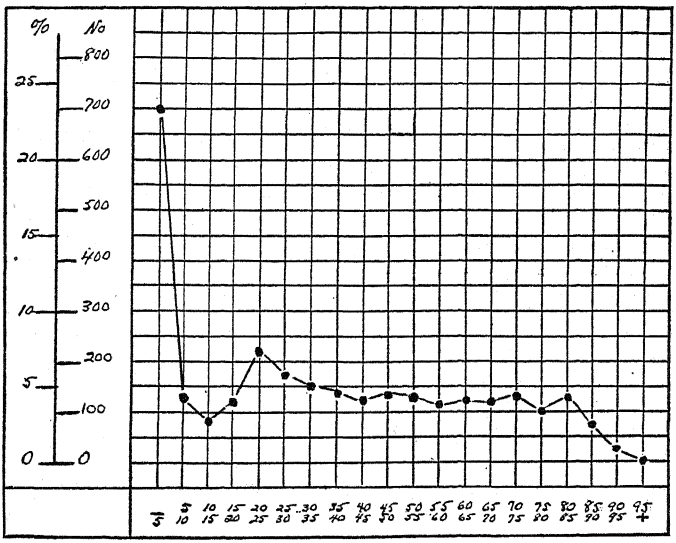


Fig. 3.—Mortality by age periods, under five, five and under ten, ten and under fifteen, etc. Note the danger periods: under three, and, at adolescence, under twenty-five. (From "The Duration of Life and Condition Associated with Longevity," by Alexander Graham Bell, Washington, D. C., 1918, p. 10.)

denies disease. Contrariwise, it is the plainest matter of statistics and common sense observation that the nation's vitality is wasted by lack of application of the available preventable measures of science.

In terms of morbidity and mortality rates the resources of the nation are squandered more recklessly, more continuously, and more surely in peace than in war. The peace losses are not so dramatic, but just as significant.

We are inclined to speak of the tremendous loss of life in war, and we are horrified by such disasters as the *Titanic*, and the ones at Halifax and Mt. Pelee. Because of custom and traditional belief that babies die easily we have grown careless about the loss of life below the age of five (Fig. 3). The significance of this loss in England has been pointed out by George Bernard Shaw in an address on the Nation's Vitality. He is quoted in part:

"If we take the number of babies conceived in the womb of the women of this nation and who ought to be born, we have 938,000. The number that succeeds in getting born is about 800,000. This is not a good beginning. It means that 138,000 have not sufficient vitality to get themselves born; it also means that the mothers were not properly fed and properly instructed. Of the 800,000 who do manage to enter the world, 100,000 die before they are one year old. This means dirty milk or no milk at all—slums, bad food, ignorance. We lose 100,000 before one year of age; we drop another 100,000 before the age of fifteen, just when they are becoming industrial producers and available for military service, and of the remainder who do grow up we find that another 100,000 have to be rejected for military service because they are unfit; that is 57 per cent destroyed in peace for the ½ per cent destroyed (in one year) by the whole German army firing shot and shell at them."

Losses That Cannot Be Easily Stated.—By using statistics we can with fair accuracy determine the economic loss that comes from deaths and illnesses that are preventable. There are other losses, however, that are not so readily estimated. The losses in the purely personal, in the human sphere that show in the psychologic effect upon the mind and spirit are not computable. These losses are in the accumulation of sorrow, in the depression that follows the breaking up a home long established. Indirectly flowing out of the losses of preventable sickness and death are a number of social problems. The close relation between sickness and inefficiency, between poverty and sickness is a correlation that has long been apparent to those who work in the field of the social agencies.

++++++++++++ TABLE I ++++++++++++

+++++++ PRINCIPAL CAUSES OF DEATH* +++++++

Rank of the ten most important causes of death in various age groups of the white population of the Registration States, 1932.

Cause of death.[1]	Rank[2] of ten most important causes in each age group.						Mortality for all ages.	
	Under one year.	1–14	15–24	25–44	45–64	65 or over.	Rate per 100,000.	Per cent of total deaths.
Heart diseases	..	6	4	4	1	1	194.4	18.5
Cancer	..	..	10	5	2	4	107.5	10.2
Influenza and pneumonia	2	1	3	3	5	5	100.2	9.5
Nephritis and other kidney diseases	..	..	8	7	3	3	87.3	8.31
Cerebral hemorrhage[3]	..	..	..	10	4	2	86.6	8.25
Accidents	5	2	1	2	6	6	71.1	6.8
Early infancy and malformations	1	..	..	..	..	..	51.5	4.9
Tuberculosis, all forms	9	7	2	1	7	10	49.4	4.7
Angina pectoris and coronary diseases	..	..	..	..	8	7	33.3	3.2
Diabetes	..	..	..	..	9	9	23.1	2.2
Suicide	..	..	7	8	10	..	18.8	1.8
Arteriosclerosis	..	..	..	..	..	8	18.0	1.7
Diarrhea and enteritis	3	3	..	..	..	..	14.4	1.37
Appendicitis	..	5	6	9	..	..	14.4	1.37
Hernia and intestinal obstruction	7	..	..	..	..	..	10.0	0.95
Puerperal state	..	..	5[4]	6[4]	..	..	9.9	0.94
Homicide	..	..	9	..	..	..	5.7	0.54
Syphilis	8	..	..	..	..	..	5.3	0.50
Diphtheria	..	4	..	..	..	..	4.5	0.43
Whooping cough	4	9	..	..	..	..	3.8	0.36
Diseases of pharynx and tonsils	..	10	..	..	..	..	3.6	0.34
Diseases of ear and mastoid	10	..	..	..	..	..	3.3	0.32
Scarlet fever	..	8	..	..	..	..	2.3	0.22
Thymus gland	6	..	..	..	..	..	1.0	0.10

* From Next Steps in Public Health, Milbank Memorial Fund, 1936.

[1] The causes shown are those which in some age group were among the ten most important. The list does *not* give the 24 highest causes of death at all ages; but the first ten shown are the ten most important causes of death at all ages.

[2] Some groupings of specific causes of death have been made and slight changes in rank would result if different groupings were used; also the order changes slightly in different years, especially the rank for pneumonia deaths and accidental deaths in adult ages and the rank of the communicable diseases in childhood.

[3] Includes cerebral embolism and thrombosis, softening of the brain, hemiplegia and other paralysis, cause unspecified.

[4] When deaths of women only are ranked, diseases of pregnancy, childbirth, and the puerperal state rank second for women age fifteen to twenty-four years and third for women age twenty-five to forty-four years; the death rate from these causes was 41.3 per 100,000 women age fifteen to forty-four years.

Estimated Losses.—Realizing that there are losses which cannot be computed, we yet may estimate the economic loss due to the death of persons from preventable causes.

Various estimates have been made of the worth of human

life in monetary units and hence the loss that accrues from preventable deaths. In Fisher's report on the nation's vitality, the money value of an individual ranged from $90 at birth through a high point of $4100 at thirty years of age to $700 at eighty years.

Every year about 1,300,000 persons die in the continental United States, and on Fisher's basis of preventability of 42 per cent the loss in dollars would approximate $1,000,-000,000. Dublin and Lotka[1] have made a more detailed analysis of the money value of a man than previous American writers on this subject. They present tables giving values for individuals of different earnings at ages from birth to the middle seventies. For persons in the $2500 maximum annual earnings class, the net future earnings of an individual eighteen years of age is given by Dublin and Lotka as $28,644. With higher annual earnings, the worth of the individual increases.

If we estimate the annual loss from deaths that are reasonab'y preventable to equal $1,000,000,000, it may not seem extravagant to estimate that $5,000,000,000 would be representative of the loss that comes from persons not living at their best. Of course, it may be very much less or very much more than that.

Revelations of the Selective Service Draft.—The results of the draft examinations were enlightening. The record indicates our national weakness. The Provost Marshal General's report shows the following:

Total men called	3,082,945
Total examined by local boards	2,510,706
Total rejected by local boards for physical reasons	730,756
Percentage rejected of those examined	29.11

To this percentage of rejections by the local board should be added the rejections at the cantonments. The medical corps at the cantonments rejected from 2 to 11 per cent of the men certified by the local boards. The total rejections must, therefore, be somewhere between 30.53 and 36.80 per cent.

[1] Dublin, L. I., and Lotka, A. J.: The Money Value of a Man, The Ronald Press Co., New York, 1930.

If we applied Fisher's estimate of 42 per cent preventability to those cases rejected by Draft Boards we should have over 300,000 additional men between the ages of twenty-one and thirty-one for service to the nation. The incompetence, the social maladjustments, the sickness, the early deaths in this 300,000 cannot all be measured. The blighting of hopes, the broken dreams of parents, the lowered vitality due to sorrows, disappointments, and failures cannot be measured. Putting the whole health problem on the economic[1] and social levels we find an imperative need not only to prevent sickness but also to improve the quality of life.

Factors in the Health Problem.—As we have seen, statistics show a great amount of preventable sickness, preventable deaths, lowered vitality, and general physical unfitness for life. Often the factors at work producing ill health appear hopelessly complex. Frequently a circle of unfortunate circumstances seems to inclose the individual, and it becomes quite impossible to dissect out the factors that explain the problem. In general, the life of any individual reflects the play of two sets of forces upon him. One is represented by his biologic inheritance, commonly called heredity; the other is his social inheritance, commonly classed under environment. How any individual reacts in the problems of life that confront him is an expression reflected in the force of these two influences.

The exact and full force of these two exceedingly complex inheritances is not known, although in specific cases, the effect of single aspects of either may be recognized clearly even though it is impossible to assign precise values. How these influences operate in general may be described by a supposition contrary to fact. Thus, if all persons had an equal inheritance of vitality to live until seventy years of age and if they lived under identical environmental influences that in no way impaired this vitality or interfered

[1] The political economist would make a more critical analysis of the worth of a human life than the one given here. Read Essays in Social Justice by T. N. Carver, Harvard University Press, 1916, pp. 173–202.

with the attainment of seventy years, then, as Sydenstricker points out, "that population would have no infant mortality nor deaths among children, young adults, middle-aged persons, or at any age until the allotted days of all were fulfilled."[1] The mortality curve would be a straight line instead of the curve that now exists (Fig. 4). The factors

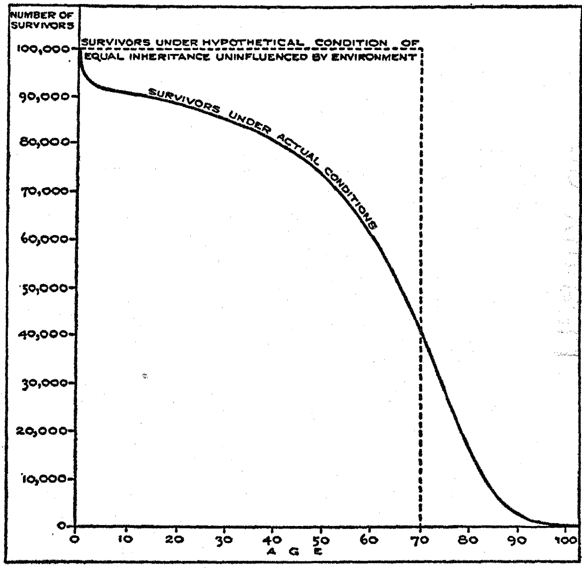


Fig. 4.—Number of 100,000 persons born alive who survive at the beginning of each age interval according to the mortality rate in 1929 for the original death registration area. The broken line is drawn upon the hypothesis that every one of the 100,000 persons was endowed by inheritance with vitality to last through a life span of exactly seventy years, suffered no fatal mishaps, and was not fatally harmed by unfavorable environment. (Sydenstricker, "Health and Environment," McGraw-Hill Book Co., Inc., Publishers.)

that prevent the straight life line and that produce the curve are these two influences, heredity and environment.

Health and Heredity.—It is known that heredity contributes definitely to the vigor, vitality, or constitution of

[1] Sydenstricker, Edgar: Health and Environment, McGraw-Hill Book Co., Inc., New York, 1933, p. 1.

man. For example, it is known that certain races are more susceptible than others to certain diseases. In short, the germ plasm of certain individuals contains factors that render those individuals more liable to early sickness and early death, or, as in other cases, to hardiness and longevity.

The force of heredity is indicated by Conklin[1]: "Furthermore, from its earliest to its latest stage of development it is one and the same organism; the egg (Fig. 5) is not one being and the embryo another, and the adult a third, but

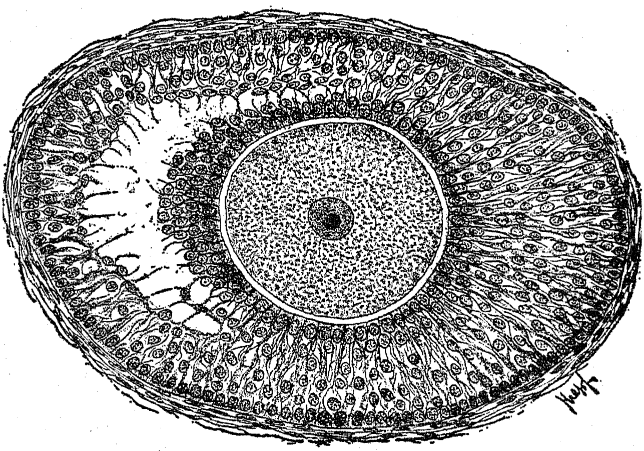


Fig. 5.—An ovum in its follicle. This sex cell (separated from the follicle cells by the white ring) carries the qualities that, together with those of the sperm cell, determine the new individual's start in life and partly shape the future course. (Böhm, Davidoff, and Huber.)

the egg of a human being is a human being in the one-celled stage of development, and the characteristics of the adult develop out of the egg and are not in some mysterious way grafted upon it or transmitted to it."

What an individual has of vitality then is in accordance with the mendelian law.[2] What he has of inherited dis-

[1] Conklin, E. G.: Heredity and Environment, Princeton University Press, Princeton, New Jersey, 1917, p. 108.

[2] Jennings, H. S.: The Biological Basis of Human Behavior, W. W. Norton and Co., New York, 1930, p. 189.

ease follows the same law. Striking illustrations are families that "catch" everything. Examples of diseases that run in families are hemophilia, color blindness, feeblemindedness and diabetes insipidus.

Health and Environment.—Although the relation of heredity to health is precise in certain instances, the unknown areas of influence are so large that no general statement can be made. This is also true for environment. Moreover, the influence of environment upon heredity and the limiting effect of heredity upon environment affect the total health picture. It is to be understood, then, that the development of any one person is conditioned by the environment into which that one comes. Thus one of theoretically 100 per cent heredity may achieve less in health and length of life than another with an inferior heredity but placed in a better environment. What that *less* is, how much *inferior* may be allowed, and how much *better* the environment must be—these are not known. The relationship is indicated merely to point out how complex are the factors, and how interrelated are the influences.

This interrelationship is emphasized by Jennings, when he writes:

> A burden of concepts and definitions—has resulted in confusion. And this confusion is worse confounded by the strange and strong propensity of workers in heredity to flout and deny and despise the observations of the workers in environmental action; the equally strange and strong propensity of students of environmental effects to flout and deny and despise the work on inheritance. If one accepts the affirmative results of both sets, untroubled by their negations, untroubled by definitions that have come from the past, there results a simple, consistent, and useful body of knowledge, though with less pretentious claims than are set forth by either single set.[1]

If heredity is complex, equally so is the environment. In general the environment encompasses two aspects, the physical and the social. The physical environment constitutes the world of nature with its widely varying climate, soils, mineral deposits, plains, forests, mountains, lakes, rivers and rainfall, insects, bacterial life, wild beasts, and the whole gamut of the geography of nature plus the adapta-

[1] Jennings, H. S.: *Loc. cit.*, pp. 139–185.

tions and constructions of man as represented in such items as subways, apartment houses, cultivated fields, lands denuded of timber, exploited coal mines, use of electricity, radio, and moving pictures, elevated trains, horns, motor exhausts, brakes, newspapers, and a countless number of implements and devices of an industrial age.

The social aspect of the environment is represented by people and their actions. The latter are expressive of customs, traditions, superstitions, and institutions that man has created. Thus, home training, and education in various institutional forms are environmental factors. So influential are all these aspects of the environment upon man that the conduct of an individual is never to be explained by merely examining what he has done. His conduct has taken place in a situation and how he reacts is an expression in part of what he has received from the environment. In recent years this relationship is expressed in the phrase, "The total situation." MacIver stresses this relationship when he writes:

> . . . our environment is not the world about us but rather that world, with all its aspects, as it comes into relation with our lives. The more complex the life the more complex must the environment be, and the more complex the adjustment to this total environment.[1]

Influence of the Physical Environment.—There are many illustrations of the physical environment deleteriously affecting health. A few of these will be discussed. Malaria, one of the greatest scourges of the human race, occurs typically in places where there is stagnant water and long periods of warm weather. These two conditions of the environment favor the growth and development of the *Anopheles* mosquito which carries the parasite that produces the disease. Malaria may be carried into northern areas by infected persons, but the disease has a favorable geographical environment. This environment may be corrected. The Pontine marshes may be drained, Havana homes may be screened, and the swamps of the Canal

[1] MacIver, R. N.: Society, Its Structure and Changes, Long and Smith, New York, 1933, p. 349.

Zone oiled—all efforts of man to alter an unfavorable physical environment.

Goiter shows a geographical distribution (Fig. 6). This disease is due to iodine deficiency in food and water supplies. This may be corrected by adding iodine to the diet (Chapter VII).

Hookworm is more prevalent in the southern than in the northern part of the United States. The short season of cold favors the parasite which causes the disease, and social factors of insanitary waste disposal and going bare-

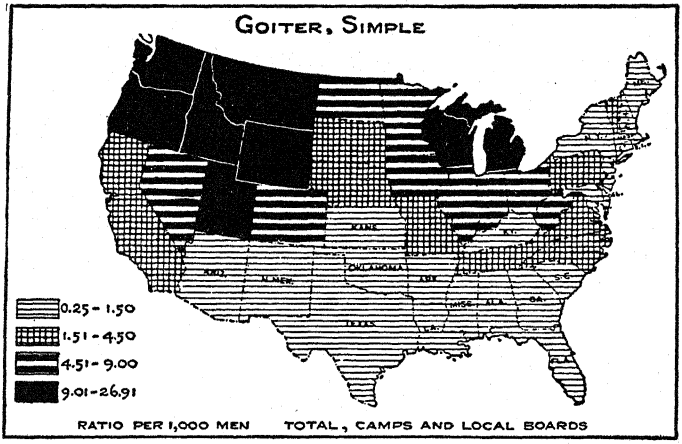


Fig. 6.—Prevalence of goiter as found upon medical examination of recruits in camps in the United States, 1917–1918. (Davenport and Love: "Defects Found in Drafted Men," Washington, 1920.)

foot combine to produce an environmental disease in part due to physical and in part to social environment.

If mortality rates alone are considered, spurious relationships may appear. Thus syphilis shows a geographical distribution (Fig. 7) but the higher rate is an expression of social not physical environment. Colorado shows a higher mortality for tuberculosis in males, thirty to forty years of age, than Montana, Maine or New York; and Colorado, New Mexico, Arizona, and California give a higher prevalence of tuberculosis in recruits (Fig. 8) than in other states,

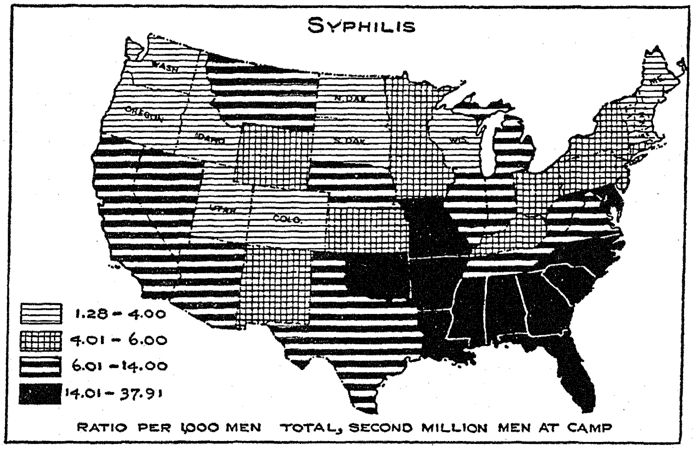


Fig. 7.—Prevalence of syphilis as found upon medical examination of recruits in camps in the United States, 1917–1918. (Davenport and Love, "Defects Found in Drafted Men," Washington, 1920.)

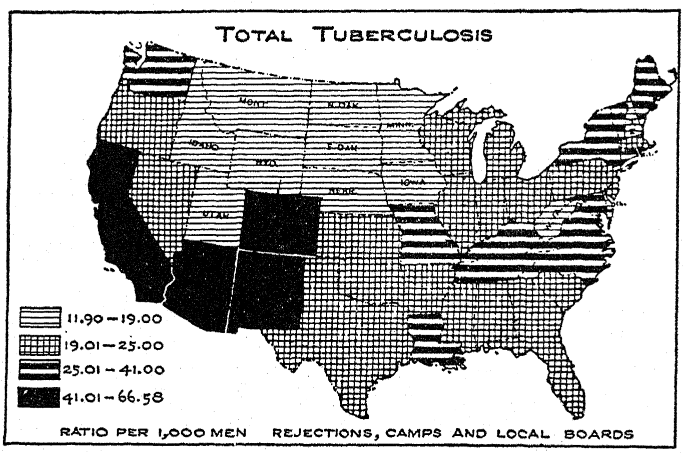


Fig. 8.—Prevalence of tuberculosis as found upon medical examination of recruits in camps in the United States, 1917–1918. (Davenport and Love, "Defects Found in Drafted Men," Washington, 1920.)

but the very favorableness of these states for the treatment of tuberculosis shows not the effect of geography in producing disease but, since the facts of migration are known, only a picture of population movement.

Health and Urban Life.—In describing the physical environment, two aspects were noted. One was the broad field of nature; the other the structures and modifications made by man. This human influence may be seen everywhere—even tilled fields of a rural scene are the products of man's ceaseless effort to change his environment, but by far his greatest efforts are produced in communities where people live together, and especially in large cities. It is difficult to discern sharp differences between small village and rural life, but no difficulty exists in contrasting life in a large city with life on a farm. In environment, as with many other facts of life, the mean cases do not distinguish; it is the extremes that do.

It is a rather widespread, popular belief that life in the country is more healthful than in the city. Tuberculosis, pneumonia, heart disease, and nephritis give a higher rate in urban than in rural groups. In some health disturbances, such as carious teeth, genito-urinary disease, typhoid fever, hookworm, gastric disturbances, gallbladder and appendix, the rural male exceeds that of the same sex in the city rate. The statistics on these rates should, however, not be taken too literally because of the fact that they are collected with respect to the place where death or illness occurred and not with respect to the prevailing life of the individual. Since these communities—urban and rural—differ also in biological inheritances, occupational activities, institutional influences and in countless other ways, it is quite impossible to assign to the intrinsically urban factor or the uniquely rural factor the determining influence for differences in mortality rates. For example, it would seem that persons with tuberculosis would do better in the country than in the city but in this disease emotional well-being is so important in treatment that in some cases the city is preferable.

Health and Economic Status.—Sydenstricker in writing of

health and economic status presents a thesis that appears sound. He writes, "To the extent that the effective conservation of that vitality which we inherit is purchasable in the market, health is determined by economic status."[1]

Poverty and ignorance are inseparable companions of disease, and when accompanied by defective heredity place formidable barriers in the way of fine living.[2] The very close correspondence existing between poverty and sickness (Fig. 9) is expressed by a report of the New York Associa-

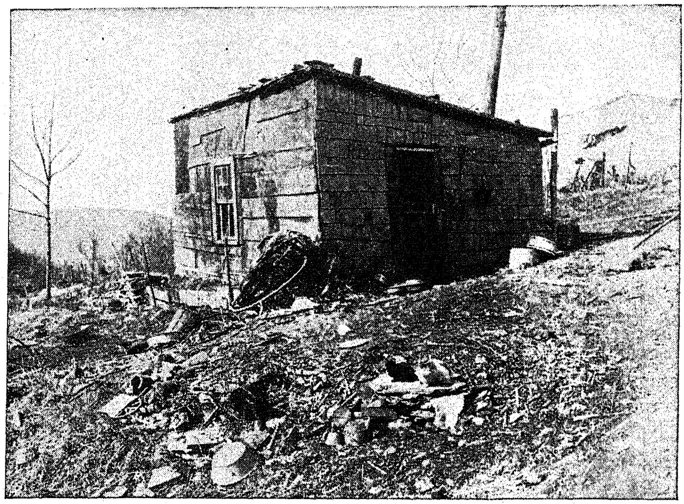


Fig. 9.—Social workers have long recognized the close relationship between poor housing and sickness. (Courtesy Milbank Memorial Fund.)

tion for Improving the Condition of the Poor. It shows that out of thousands of dollars spent in relieving destitute families, 96 per cent was given to families who had to seek aid because of sickness or death in the family. The Charity

[1] Sydenstricker, Edgar: Health and Environment, McGraw-Hill Book Co., Inc., New York, 1933, p. 85.

[2] Draper, G.: Studies in Human Constitution, *Journal American Medical Association*, February 9, 1924, p. 431. See an article by Pearl, same journal, January 26, 1924, p. 259.

Organization Society in a report[1] by the Committee on the Prevention of Tuberculosis records the social study of 35 families suffering from tuberculosis. In one place the report says:

> Reclassifying these 35 families in an attempt to relate their economic dependency to their tuberculosis condition, we find that:
>
> (*a*) Prior to tuberculosis infection
>
> Twenty-one families were apparently self-supporting.
> Eight families were occasionally dependent.
> Six families were chronic dependents.
>
> (*b*) After tuberculosis infection
>
> One family still apparently self-supporting (received sanitation outfit only).
> Twenty-seven families received occasional relief.
> Seven families were chronic dependents (*i. e.*, received some regular allowance, which was main support of family).

Practicing physicians and social workers believe that sickness is most common among those least able to afford it. Sydenstricker[2] in a study found the sickness rate highest in the poor, next in the moderately well-to-do, and lowest in the well-to-do group. This distribution was most marked in middle age whereas the differences tended to disappear in adolescence and old age. Part of the answer may reside in Sydenstricker's statement: "Those families which were definitely above the average of this community in economic condition had medical attention to a considerably greater extent than the remainder of the population."

An enlightening report[3] of the Association for Improving the Condition of the Poor shows conclusively that in the Mulberry section of New York City the unemployed suffered more sickness than the employed, and that this association of idleness and sickness persists after all cases in which sickness is the cause of idleness have been eliminated. While health may suffer more from excesses than from restraints the fact is incontrovertible that poverty, unem-

[1] Tuberculosis Families in Their Homes, p. 33. The Association of Tuberculosis Clinics and the Committee on the Prevention of Tuberculosis, Charity Organization Society, New York, 1916.

[2] Sydenstricker, E.: Economic Status and the Incidence of Illness, Public Health Reports, July 26, 1929.

[3] Berry, G. H.: Idleness and the Health of a Neighborhood, New York Association for Improving the Condition of the Poor, 1933.

ployment, and economic distress of all kinds are factors in the production of sickness.

There is considerable evidence on mortality rates according to economic status, although the possible influence of biological inheritance should not be omitted. For example, intelligence is clearly an inherited trait and in a situation of equal educational opportunity the better intelligence may more quickly learn and utilize the facts of preventive medicine so widely disseminated today. While due recognition should be given to this fact, the data on infant mortality and economic status are extremely convincing. In infancy there are many items that are *purchasable*, the absence of which seriously impair the inherited vitality of the child. These are adequate diet, protection against infections, housing, cleanliness, nursing and medical services.

In discussing the relationship between health and economic status, Sydenstricker gives an excellent summary. He is quoted at length:

> A definite inverse association between the amount of income and the incidence of sickness and death is clearly shown by a considerable body of evidence. If income or economic status were determined entirely by inherited constitutional strength, by innate vitality, then we should be limited to the conclusion that these differential rates of sickness and death were due entirely to these differences in heredity. But we know that heredity alone does not select which persons are to be in one economic class or another, although undoubtedly it plays a part; on the contrary, economic status is itself determined largely by environment and is a part of man's total environment. Furthermore, differences in economic status exist among persons of the same constitutional inheritance, with the result that some cannot control their environment, through the purchase of essentials for the conservation of health, to the extent that others can. Conversely, some with an abundance of income purchase goods and possibly services that impair health. These differences are reflected, on a logical basis, in differential rates of sickness and death according to economic status.[1]

The influence of the economic factor in the health problem has given rise to demands for the socialization of medicine. Both Germany and England have had experience with this measure and the report of the Committee on the Costs of Medical Care has given recently renewed impetus to the

[1] Sydenstricker, E.: Health and Environment, McGraw-Hill Book Co., Inc., New York, 1933, p. 108.

discussions in America. Obviously many persons are unable to secure the medical aid they require to maintain health and to fight successfully the onset of disease. Equally apparent is the inability of the medical profession to serve mankind properly on a basis of private practice. The issue is not clear in all respects, but doubtless tradition, clouded somewhat by the mores of a *laissez faire* philosophy, plays an important rôle. There are numerous articles in the literature dealing with the problem.[1]

Health and the Social Environment.—The social environment was defined in terms of the customs, traditions, superstitions, and institutions that man has created. Presumedly these have pronounced influence upon health although no exact statement of degree can be made.

Customs, traditions, and superstitions provide numerous examples of the way in which health is compromised. The practice in some rural areas of placing a poultice of plantain leaves upon cuts and wounds, the practice among some negroes of treating headache by tying an onion on the top of the head, reliance upon sulfur and molasses as a spring tonic, the use of pacifiers for infants, suspicious attitude of parents toward school doctors, dentists, and nurses, reliance upon individual effort and distrust of board of health regulations with corresponding disobedience—these and numerous other beliefs and practices doubtless have a pronounced effect upon health.

Human institutions such as the home, school, and church have meanings for the health of people. Health and the family may be seen both as science and art. Social science of the family dealing as it would with diet, housing, budgets, and familial disease, tells part of the story. The applica-

[1] Wilbur, R. L.: The Economics of Public Health and Medical Care, The Milbank Memorial Fund, Quarterly Bulletin, July, 1932, pp. 169–190. Report of the Committee on the Costs of Medical Care, "Medical Care for the American People," University of Chicago Press, 1932. Armstrong, D. A.: A Study of Sickness Cost and Private Medical Practice, Metropolitan Life Insurance Co., May 13, 1932, pp. 3–15. Armstrong, D. A. *et al.:* What Medical Care Costs the Average Family, The Modern Hospital, November, 1933. McCleary, G. F.: Health Insurance in Europe. The Milbank Memorial Fund Quarterly, January, 1934, pp. 3–14.

tion of knowledge about living in real life experiences is an art and is nowhere more vital than in family life. Reduction in size of the family may have pronounced effect upon health of parents as well as children and a more rational attitude toward sex ought to result in fewer cases of domestic maladjustment with its accompanying health disturbance.

Less rigid beliefs regarding religion, extension of the functions of schools, and the adult education movement have created gradually but inevitably a new world of human beings whose ideas about life, health, work, play, love, and religion would not have been understood nor tolerated by our ancestors only a few generations ago.

Industry, organized in factories, is a human institution with precise health relationships. Occupational hazards are specific and well known.[1] Some of the more prevalent are lead poisoning, phosphorus poisoning, radium poisoning, silicosis, caisson disease, and industrial accidents.

An Assessment of Efforts to Change Heredity and Environment.—As man has discovered the conditions that produce disease and has learned how to overcome these he has instituted efforts to combat them. These hereditary and environmental factors are exceedingly complex, as the previous pages will reveal, and hence there has been much stumbling in man's effort to make a better world in which to live.

Efforts to improve biologic inheritance have not been brilliantly successful. Indeed little progress has been made. In an effort to improve racial stock and to prevent propagation of the biologically unfit, social action relating to marriage and propagation has appeared. Appreciating the real danger to the health and vigor of the nation in the numerous children born of diseased and defective parents, state legislatures have passed laws attempting to make marriage difficult for those who are unfit, or if married and unfit, to propagate their kind.

The effort to control marriage is illustrated in the Eugenic

[1] Williams, J. F. and Oberteuffer, D.: Industrial Hygiene for Schools, McGraw-Hill Co., New York, 1930.

Marriage Law of Wisconsin. This law is of insignificant value because it is easily and readily evaded, does not secure a blood test that would rule out syphilis, and is not accompanied by educational efforts to develop sanction for its provisions. Essentially, then, it is not worth a great deal because it has not quickened the citizens of the state to habits of response that would favor racial service and racial integrity above personal likes.

The effort to prevent propagation is directed at the sterilization of persons unfit to be parents. Sterilization laws have been passed in numerous states with the results of the laws shown in the following:

Operations for Eugenic Sterilization Performed in State Institutions under State Laws up to January 1, 1933

State.	Male.	Female.	Total.
Alabama	73	58	131
Arizona	10	10	20
California	4423	4081	8504
Connecticut	18	320	338
Delaware	181	115	296
Idaho	4	9	13
Indiana	159	58	217
Iowa	56	38	94
Kansas	588	388	976
Maine	5	36	41
Michigan	264	819	1083
Minnesota	72	621	693
Mississippi	1	11	12
Montana	33	48	81
Nebraska	94	135	229
New Hampshire	23	142	165
New York	1	41	42
North Carolina	10	36	46
North Dakota	56	37	93
Oklahoma	0	0	0
Oregon	296	586	882
South Dakota	55	84	139
Utah	44	41	85
Vermont	8	22	30
Virginia	479	854	1333
Washington	6	24	30
West Virginia	0	1	1
Wisconsin	40	452	492
Total	6999	9067	16,066

A committee of the American Neurological Association[1] in a recent report on Eugenic Sterilization makes the following recommendations:

1. Our knowledge of human genetics has not the precision nor amplitude which would warrant the sterilization of people *who themselves are normal* in order to prevent the appearance in their descendants of maniac-depressive psychosis, dementia praecox, feeblemindedness, epilepsy, criminal conduct, or any of the conditions which we have had under consideration. . . .
2. Particularly do we wish to emphasize that there is at present no sound scientific basis for sterilization on account of immorality or character defect. . . .
3. Any law concerning sterilization passed in the United States under the present state of knowledge should be voluntary and regulatory rather than compulsory. . . .
4. Any law concerning sterilization should be applicable not only to patients in State institutions, but also to those in private institutions and those at large in the community. . . .
5. The essential machinery for administering any law in regard to sterilization should be one or several boards composed chiefly of persons who have had especial training and experience in the problems involved. . . .
6. Adequate legal protection for the members of such a board, and for the surgeons carrying out the recommendations, should be secured by statute. . . .

Such a board of experts would recommend sterilization only for especially selected cases of:

1. Huntington's chorea, hereditary optic atrophy, familial cases of Friedreich's ataxia, and certain other disabling degenerative diseases recognized to be hereditary.
2. Feeblemindedness of familial type.
3. Dementia praecox (schizophrenia).
4. Maniac-depressive psychosis.
5. Epilepsy.

The efforts of society to provide for the repression of unfit types and to promote finer and more desirable types must be built around socialized attitudes and secure the development of habits of control that will serve society.[2] There should be, unquestionably, among all people a stronger appreciation of the value of a strong biological inheritance. This can be secured only by home and school education in which certain social attitudes will be approved and the opposites disapproved. Such education of young people

[1] Eugenical Sterilization—Committee of the American Neurological Association, by permission of The Macmillan Co., publishers.

[2] Anon.: The Glass of Fashion, G. P. Putnam's Sons, New York, 1921, pp. 137–166.

would make it difficult for strong types to "fall in love" with weak and wholly undesirable biological types. Such education would not rule out love and romance, but would simply control through habitual attitudes the choices that would awaken love, just as habituation, the result of conditioning with reference to races, makes it impossible in almost all cases for the white and Negro to marry. There are from a biological standpoint many marriages that are as catastrophic in their biological effect as the marriage of white and Negro may be socially. Such education of the young would make not only for health in the individual himself, but, in addition, would provide the basis for intelligent love in line with the principles of eugenics.

All persons interested in eugenics will watch with considerable interest the measures and evidences of achievement in Germany today to improve racial purity. The law dealing with sterilization that went into effect January 1, 1934, has been translated as follows by Peter.[1]

> Those hereditarily sick may be made unfruitful (sterilized) through surgical intervention when, following the experience of medical science, it may be expected with great probability that their offspring may suffer several physical or mental inherited damages.
>
> The hereditarily sick, in the sense of this law, is a person who suffers from one of the following diseases: inborn feeblemindedness, schizophrenia, circular insanity, hereditary epilepsy, hereditary Huntington's chorea, hereditary blindness, hereditary deafness, severe hereditary physical deformity. Further those may be made unfruitful who suffer from severe alcoholism.
>
> This procedure, reaching about 400,000 persons, is different from the permissive and educational character of sterilization in the United States. If the German results indicate effectiveness in reducing serious hereditary disease and defect, they may hasten similar procedures here.

In man's efforts to improve environment two main lines of endeavor have appeared. One is the public health movement resting upon the technics of sanitary science and supported by laws that gave police powers to boards of health; the other is the effort to improve social and economic status of the underprivileged members of society. The latter effort has employed legislation to secure its objec-

[1] Peter, W. W.: Germany's Sterilization Program, *American Journal of Public Health*, March, 1934, p. 187.

tives and has been particularly successful in improving conditions of work in factories, and in controlling occupational diseases. Organized social work cooperating with official public health agencies has contributed richly to protection against tuberculosis, gonorrhea and syphilis, pellagra, hookworm, and other diseases. This coordination is based upon

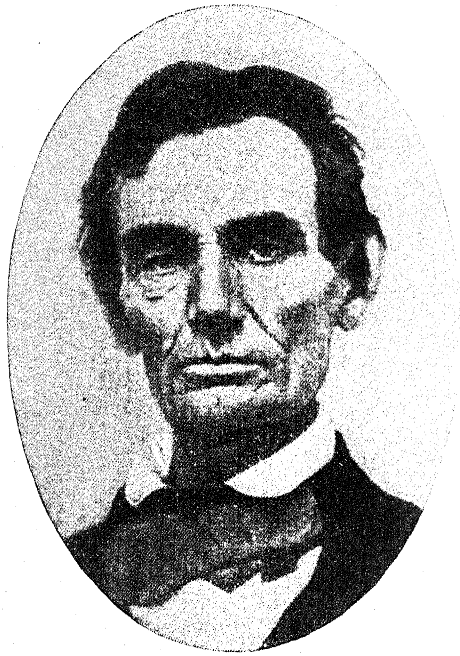


Fig. 10.—Lincoln's environment had many desirable elements: it required initiative, responsibility, resourcefulness, and courage.

the understanding that public health efforts to combat disease are dependent for success upon agencies that will help to relieve and prevent social and economic distress. The broad environmental aspects of health are thus recognized.

Education and Health.—The environment encompasses all the influences that affect the individual after birth.

All educational agencies are environmental, and yet with free public school education available and even free university education within reach of most young people in the United States, there is a tremendous variation in living that is difficult to trace to heredity and seems to have no relation to wealth, social status, attendance at schools, and similar well recognized factors. Doubtless there is a parental influence and exigency, highly personal and individual (Fig. 10). At times, doubtless it is a Mark Hopkins relationship. Always it is a manifestation of ideals. Education that is more than the learning of subject matter and that becomes concerned with the attitudes, interests, and ideals of young people touches vitally the health problem. The finest heredity and the most favorable physical environment will not remove the health hazards that continually arise before the following types:

1. *Those Satisfied with Low Levels of Achievement.*—The notion that health is freedom from disease leads inevitably to neglect of effort to learn and to practice ways by which a person can improve his functioning. A person may be rightly satisfied with his muscular strength, his posture, his digestive powers, his vital capacity, his endurance to withstand fatigue, his level of alertness, his emotional control, and numerous other functions. But such functions can often be improved and many persons fail to care. Moreover, such improvements are not necessarily dependent upon settlement of pressing economic problems, the betterment of environment, nor the elimination of poverty, however desirable these may be. In large part they depend simply upon the effort of an individual to learn and to practice hygienic knowledge.
2. *Those Who Trust That Nature Is Right.*—The notion that the human organism, being a product of Nature, needs no particular guide except that provided by instinct is responsible for much poor living, considerable disease, and needless distress. It is apparently forgotten by those holding such views that intelligence is as surely a product of Nature as instinct.

   There is considerable reason to believe that, unless man takes intelligent charge of his living, the amazingly rapid changes in the conditions of life in an industrialized society will bring disaster and that less can be said for living than is commonly supposed. The evidences of increased mortality in the chronic degenerative diseases, the physically awkward and diseased citizens, the rapidly increasing number of nervous and mental cases in hospitals, the growth of crime and delinquency—these are signs that show clearly that instinct is not an adequate guide for living in the modern world.

3. *Those Who Doubt That Hygiene Is Worth While.*—These may be either the prominent physician who writes (with his tongue in his cheek, perhaps), "An impartial examination of all the means yet proposed to prevent early death or lengthen life leaves me with the conviction that nothing anybody does to himself after he is born makes more than a few hours difference at the most,"[1] or the callow youth whose ignorance of the ways to prevent disease does not deter him from making the assertion that hygiene contributes nothing to life.

   On the contrary, the evidence for hygiene is overwhelming. For example, the newer knowledge of nutrition today testifies precisely and explicitly to the rôle of vitamins and minerals in the prevention of disease. For over two centuries the worth of vaccination against smallpox has been established. Dental and oral hygiene are not fads regardless of the extreme claims made by dentrifice manufacturers.

   Fortunately, for those who doubt hygiene and its service to man, society is as safe as it is because of the practices of those other persons who believe in hygiene.

4. *Those Who Lack the Long-range View.*—Those who have the ability to project into the future the acts of the present possess a view of the possible cumulative effects of an act that gives to the immediate situation the significance that it ought to have. Life is made up of the experiences that occur, and present practice builds the future in a thousand ways. The life that is made is the life that must be lived. Only as the full meaning of these truths is understood can present practice be examined correctly in terms of what it will yield over the years and through them.

   The taste of sweet upon the tongue, this wish or that desire, are quite sufficient motives for those whose preferences are made in terms of the momentary appeal. On the other hand, discipline of self for remote ends, denial of the immediate for a distant and better goal, selection of present means for the attainment of distant ends desired—these are central problems in hygiene.

The health problem will be solved only when education in all its power is brought to bear upon problems of human living. Legislation is helpless without its interpreting aid, and problems of heredity can be solved for man only by its sanctions. The social legislation of the day is ultimately dependent upon education for its success.

Lack of Education.—Much of the present need for public health work and many errors in personal hygiene are due to lack of education of a proper kind at the right time. It is a matter of common knowledge that often people

[1] Reprinted from "The Human Body," by Dr. Logan Clendening, by permission of and special arrangement with Alfred A. Knopf, Inc., authorized publishers.

resent the effort to improve living conditions. Organizations aiming at health values and providing health programs meet opposition in carrying out programs of health preservation. This opposition is less marked today than formerly, and it is reasonable to suppose that with more education in such matters it will cease to be a direct and active deterrent of health administration.

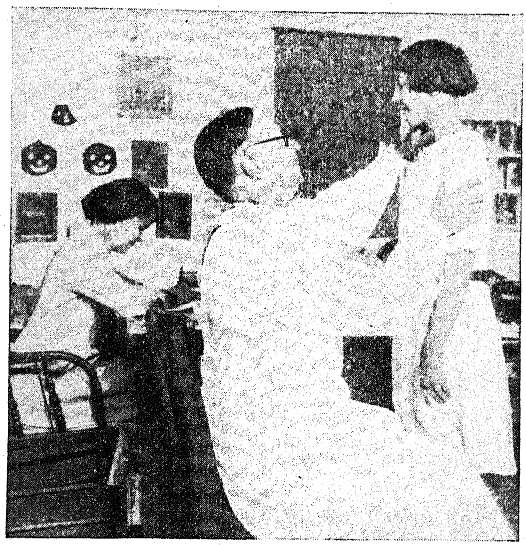


Fig. 11.—A medical inspector examining a rural school pupil for goiter. In the records of the 7944 school pupils examined in the Cattorangus County Survey, 679 had goiter. (Courtesy Milbank Memorial Fund.)

To this end the fact must be realized that the home and the members of the family are not laws unto themselves. The mother who sends a child to school when she knows he is not well will more and more receive the censure of the community, because in doing so she imperils the health of the other children in the school. Health service (Fig. 11) in the schools to be reasonably successful must have the loyal cooperation of the parents of the school children.

The education of the parent in proper attitudes toward society would help the parent to be as interested in preserving the health of the other children in the school as she is in expressing the maternal instinct for her own child. The infrequency of such response is a token of the lack of education in this regard. And yet there is only one standard that American citizens are willing to accept. This standard has been expressed by Professor John Dewey: "What the best and wisest parent wants for his child, that must the community want for all of its children."

The mother who is angry because the School Dentist advises that Johnny's teeth be filled, and the merchant who objects to the restriction of the Board of Health in withholding a license because his shop is insanitary, are individuals who lack a social education. Such individuals may be educated to avoid for themselves the causes of disease, but they are defective in social training. Their health is of some value in proportion as they are able to support themselves and cause no burden to the state, but as regards their ability to cooperate with society in advancing the best interests of all they are socially sick. The individual factor in health may completely overshadow the influence of heredity and environment. It is clear, therefore, that instruction in hygiene must be something more than stating the number of hours of sleep that man needs or the kind of clothes he should wear. Informational education is always necessary, but it must be made effective by habituation, proper attitudes, and ideals.

The Dynamic Force of an Ideal.—"To make the world safe for democracy," "to win the war," caught the ear of a people awakened to the significance of a great drama in history. Catch phrases that adorned cheap posters they were, and yet expressive of a grim determination, fighting for lofty ideals. Out of the World War arose high idealistic motives that inspired many to become interested in personal health as an aspect of national service. During the war groups could be seen in more than one city cheerfully joining in a morning tramp to promote vigor, or following some special prescription dictated by a medical examination.

Boy Scouts, Girl Scouts, and other young persons were similarly inspired. But the war did not last long enough to secure habituation in such modes of living.

Now the war is over! The great dramatic "hinterland" of "beating the enemy" is gone! Something else is needed to perpetuate and to carry on this spirit of service—an ideal that will give habitual attitudes on all problems of living, an ideal that will be above economic values or instinctive urges, an ideal that will secure maximum efficiency and achieve a level of performance above the commonplace! The answer to the health problem is concerned vitally, therefore, with a consideration of ideals and habits.

QUESTIONS AND EXERCISES

1. By a series of illustrations, show that there has been considerable effort made to conserve our national resources.
2. What do you consider the greatest resource of the nation? Defend your answer.
3. According to Fisher, what percentage of the deaths of persons in the United States could be prevented or postponed? How?
4. Justify the statement that "the resources of the nation are squandered more recklessly, more continuously, and more surely in peace than in war."
5. Show the relationship between poverty and sickness.
6. List factors which greatly influence individual health. Show that these factors are related.
7. State specifically the influences of heredity upon individual health.
8. Cite evidence to show the health of the individual is modified by environment.
9. List health problems which may be solved by legislation.
10. "As a factor in the health problem the individual and his response to all sorts of situations loom large." Elaborate.
11. By a series of illustrations, show that education is fundamental to the hereditary, environmental, legislative and individual response aspects of the health problem.
12. Show how a consideration of ideals is of paramount importance in a health habit program.

CHAPTER III

INTELLIGENCE AND IDEALS

Stages in Human Conduct.—The conduct of a man is determined by environment acting through various ways upon the original impulses, tendencies, or instincts of his nature. We may with profit distinguish, as McDougall[1] suggests, three levels of conduct, each of which represents successive stages to be traversed in turn. These stages are:

1. The stage of instinctive action in which original tendencies are expressed without modification, except that produced by the influence of pains or pleasures. Pain or pleasure in any situation is the determiner of conduct in this stage. The impulses to strike, to eat, to run away are expressed fully and completely if they give pleasure; they are inhibited if they give pain. This stage represents a maximum of nature acting and a minimum of nurture. It is found in most complete form among wild barbaric peoples. All persons, however, may show at some time this response.

[1] McDougall, William: An Introduction to Social Psychology, John W. Luce & Co., Boston, 1918, Chapter VII.

2. The stage in which the tendency to instinctive action is modified by rewards or punishments. These rewards or punishments are usually administered by the social environment or, as in the case of certain religions, they may accrue after death. In this stage also the condemnation by society of individual action prevents the continuation of the act and tends to inhibit its initiation in the future. The control here is fear. Such control by society is necessary in the present state of the world. Values of significance to the group are thus protected and conserved from destruction by the instinctive action of the individual, oblivious of social welfare. Such control for the individual is entirely unsatisfactory, because when group judgment is not acting the individual is without sufficient guides. This stage is found not only in uncivilized society but also in recognized civilized states.
3. The stage in which conduct is controlled, modified, and directed by an ideal. Under the influence of ideals, original tendencies to action are modified, strengthened, or weakened, so that the individual's conduct represents an expression of ideals. It is clear that such conduct will be called good, worthy, or right by society in proportion as the ideals serve high aims of social worth and significance. This stage is found among advanced members of civilized society.

Forces Determining Human Conduct.—The stages in human conduct show a progressive series leading from instinctive responses typical of the lower animals to the responses guided by ideals which are typical of the best in intelligent man. The problem of living finely and well, the particular problems of the health of man are expressions of the development of man in terms of these stages of human conduct. No adequate study of hygienic living can deal merely with hygienic rules because well-known hygienic rules are continually violated. Knowledge of the truth may still permit the dominance of instinct. To under-

stand the forces determining human conduct lies at the very beginning of understanding the problems of living. Instinct and intellect together are shaping human conduct.

The Force of Instinct.—All men, apart from training, possess tendencies to respond in certain typical ways to certain typical situations. These tendencies to respond are inherent in the nature of man. Without training, this nature would appear to be a vastly different thing than most persons would imagine it to be. Thorndike,[1] in writing of the need of education, says, "If all human beings save newborn infants vanished to another planet, and if by a miracle the babies were kept alive for a score of years, preserving whatever knowledge and skill came from natural inner growth, and lacking only the influence of the educational activities of other men, they would at the age of twenty-one be a horde of animals." It is unquestionably true that any individual would be ashamed to be associated with the creature he himself would be by original nature alone. Man without the influence of training would show a truly barbaric type of conduct. The instincts of his original nature subjected to no modification would exhibit the cruelties, fears, and fightings of primitive man, and perhaps even of the lower animals themselves.

There is in every human action and in all human conduct the underlying impulse to primitive instinctive expression. For some persons the first stage, as described by McDougall, represents the extent of their development as members of human society. Moreover, it is doubtless fair to say that whenever human conduct is particularly selfish, personal, and unsocial, unmindful of the rights and needs of others, the original and less socially useful instinctive forces are having full play; and, conversely, that whenever human conduct shows a subjugation of the essentially selfish, instinctive tendencies to the needs of social life, the influence of training is uppermost and the instinct of man has succumbed to the intellect of man.

The Force of Intellect.—Among barbaric peoples instinct

[1] Thorndike, E. L.: Education, p. 4, The Macmillan Co., New York, 1912.

dominates; among civilized peoples instinct is in continual warfare with intellect. In civilized society the child after birth is subjected to a variety of environmental factors, all varying expressions of man's intellect. Training (to include traditions, mores, etc.), education, nurture are the terms used to designate these factors. The quality and distribution of the environment determine the type of response seen in the members of society. The conduct of any one person is measured frequently in terms of his opportunities, other things being equal. To bring to bear upon the original tendencies influences that shall shape selfish conduct into unselfish conduct is the immediate aim of the social environment. To initiate such influences and to respond to such influences indicate the action of other than instinctive forces, in fact, indicate the operation of intellect.

The story of human development is a moving drama in which instinct and intellect with its ideals are the chief factors. Thorndike[1] describes the primacy of these ideals in the following passage:

"There is a warfare of man's ideals with his original tendencies, but his ideals themselves came at some time from original yearnings in some men. . . . Intelligence and reason are fit rulers of man's instincts just because they are of the same flesh and blood. They are not foreign conquerors, imposing a law that is better because it comes down from above. They are sons of the soil, as indigenous as hunger and thirst, chosen to rule because their laws mean the best harmony of all the instincts."

The Failure of Instinctive Guides.—Most of the original tendencies in man need the modifying influence of intelligence.[2] Some instincts need to be strengthened, some directed into new channels for expression, and some that are of real worth to be curbed under certain conditions. The instinct of the mother to care for and to protect her child is a valuable instinct not only for the child but also

[1] Thorndike, E. L.: Educational Psychology, Vol. I, p. 311, Teachers College, Columbia University, New York, 1919.

[2] Williams, F. E.: The Need for Emotional Control through Education, *Educational Review*, January, 1923, pp. 40–44.

for the race. But this instinct, while admirable in its intent, frequently results in disaster for the child. If the mother is ignorant of the cause of disease her original tendency may mean not protection for the child, but definite harm. The worthwhileness of an instinct is to be judged not by its intent, but by its results as measured in human life.

In general it seems clear that instinct alone is a failure in guiding human conduct. This is so for two reasons: the modern environment is vastly changed from the primitive in type, and the purely instinctive acts fail usually to appreciate the rights and needs of others.

The human environment has changed markedly, especially in the last two hundred years. It is becoming more and more complex and artificial, and provocative of unhealthful conditions in man. Instinct as a guide is lost in a crowded subway, in a modern restaurant, in apartment houses, in automobiles. The varied health problems that confront modern man require intelligence for their solution. This intelligence must show itself not only in the guidance of the individual through the maze of civilized forms but also in the formation by society of wise provisions for the welfare of all. Public health administration, medical inspection, scientific sanitation, instruction in personal and community hygiene, adequate opportunities and facilities for play and recreation represent an appreciable development of intelligence with reference to matters of health. Reliance on instinct to protect man from disease germs, to detect and cure disease, to properly care for waste and water supply, to know the proper way to live, or to develop adequately in an urban environment would be the height of folly. Instinct as a guide in modern civilized life is a failure because of the changed environment of man.

Instinct is a failure also because it does not appreciate all rights and needs of others. This is particularly true in manifestations of the sex instinct. This instinct, if left to itself, is primarily selfish, ruthless in its desire, unmindful of others. In lower animals under the conditions that existed in their development this instinct is useful, and thus directed by nature it is extremely serviceable to the

species. The story of the sock-eye salmon in breeding season is an epic poem of self-sacrifice for the group. In man, however, this instinct if uncontrolled in the highly developed society of modern man is productive not only of disease and ill health but also of unhappiness and individual and social disaster.

Lower forms of life may be allowed to act on a purely instinctive plane, but it is becoming more and more impossible for man to be guided only by instincts, especially as these guides are in their effects so particularly personal and individual. This control of the instinctive impulses to action is the sort of thing that we may expect to come because of the evolution of the human being. The social and moral significance of such control is understood more and more by psychologists and sociologists. McDougall says, "While the lower forms of social conduct are the direct issue of the prompting of instinct, the higher forms of social conduct, which alone are usually regarded as moral, involve the voluntary control and regulation of the instinctive impulses."

Society must, therefore, by more authority in the regulations governing human actions, provide that margin of safety that is not given by the thoughtless, the indifferent, and the mentally incapacitated. It must stimulate the development of intelligence as a guide, and must renounce, either as understood or as advocated, a theory of education that is based on instinctive response.

Intellect and Ideals.—To plan to live by intellect and not by instinct involves no negation of nature. Nature is expressing herself as well or better through intellect than through instinct. Thorndike[1] in enviable fashion says, "Intellect is of the same flesh and blood with all the instincts, a brother whose superiority lies in his power to appreciate, use, and save them all."

Not alone in man's ability to reason, use tools, and engage in constructive work is the intellect a mark of superiority over the lower animals but also by the ideals that arise as

[1] Thorndike, E. L.: Educational Psychology, Vol. I, p. 310, Teachers College, Columbia University, New York, 1919.

expressions of its activity. And the very ideals that guide and use the instincts for superior achievement in life arise out of the very matrix of man's intellectual life. To quote from Thorndike[1] again, "Its ideals are kith and kin of man's original hungers and thirsts and cravings. 'What are ideals about?' asks Santayana, with customary insight, 'what do they idealize except natural existence and human passions?' That would be a miserable and superfluous ideal that was nobody's ideal of nothing. The pertinence of ideals binds them to nature, and it is only the worst and flimsiest ideals, the ideals of a sick soul, that elude nature's limits, and belie her potentialities. Ideals are forerunners of nature's successes, not always followed, indeed, by their fulfilment, for nature is but nature, and has to feel her way; but they are an earnest, at least, of an achieved organization, an incipient accomplishment, that tends to maintain and root itself in the world."

Modern man and his barbaric brother differ in ideals or in the extent or range of their distribution. They differ in no other way essentially. But the very ideals that characterize the intellectual life of civilized man are useful for purposes of life only as they foster habitual attitudes, directing conduct. We do not have ideals to admire, or to talk about vainly, or to pray over. They are to modify conduct. In proportion as they help to form attitudes tending to lead to desirable responses are they significant.

Ideals are serviceable, then, according to the extent to which they direct action, especially as they foster habitual attitudes that lead to fine and noble responses. They are of relative value. An ideal of cleanliness for purposes of human society may not be worth as much as an ideal of fair play. All men have ideals of a kind, but we recognize poverty or wealth in this sphere by the quality of the ideal that directs and controls. In matters of health, economic values too frequently set the standard for hygiene. Thus, some persons will be interested in living hygienically because it is cheaper to keep well than to pay the expense involved in getting well, but such guidance is frequently ineffective

[1] Thorndike, E. L.: *Loc. cit.*

because it is not capable of directing those who are willing to sacrifice health to attain ends that are selfish and personal. This fact is well illustrated in the following experience:

A college student who was leaving college to enter a naval unit was recounting plans for the last night in a certain city. The plans involved drunkenness and vice in its most undesirable forms. I called to his attention the danger in loss of health through the debauchery of himself in alcohol and by the exposure to deadly venereal disease. His reply was characteristic of those whose conduct conforms to McDougall's first stage and who measure life in terms of economic values. "I'm willing to trade my health for the sake of these pleasures and entertainments." When I brought to his attention the obligation that he owed to the race for preserving the quality of health that he had so that he could pass it on at least preserved and if possible improved, he replied, "The race doesn't look after me, why should I be responsible to the race?" The problem was, then, not to give him scientific knowledge of hygiene, not to point out the economic loss due to venereal disease. He had the knowledge and he was willing to trade health for what he was inclined to call fun. The problem was to awaken in him a response to social values, to a spirit of chivalry toward not only women and men but also toward those who come after. Acutely it resolved itself into indicating the ways in which the race looked after him, and in arousing in him a sense of responsibility toward the race. He greatly needed ideals that would help to place him as an individual in the scheme of things.

The instinctive guide even when buttressed by economic supports may fail; it always fails in the crisis of life. McDougall[1] points out so clearly the fallacy in such control that it is worth while to quote him at length: "The regulation of conduct by the regard for the approval or disapproval of our fellowmen has certain limitations and drawbacks. In the first place the motives involved are fundamentally egoistic. Second, the approval or disap-

[1] McDougall, W.: An Introduction to Social Psychology, John W. Luce Co., Boston, 1918, pp. 179–233.

proval of our social circle cease to be effective sanctions of right conduct as soon as we can be quite sure that our lapse from the standard demanded of us will never be known to those in whose minds we habitually see ourselves reflected."

It is well known that the individual living on this low plane will not conform if there is no danger of being "found out." To remedy this defect many people have supplemented the sanction of public opinion with the theologic doctrine of an all-seeing eye—an omnipotent one who rewards and punishes. This doctrine is increasingly less potent today. For purposes of life we shall have to depend more and more upon ideals, and for purposes of health, *to live most and to serve best* may well satisfy the needs of health and the larger goals of life.

The problem of living finely is in part a problem of seeing straight, and seeing straight is nothing less than getting in touch and harmony with the great principles of law that rule the universe. One of these principles is the essential unity of life, and carries with it not only the inheritance of the past, but, for the individual, a real responsibility for future generations. This means ideals of a high order. To the intense individualist, to the selfish seeker of personal pleasures, and to certain types of socialists this principle means nothing.

It would have been helpful if I could have told my college student the story of Gloria Swann.[1] Gloria, a chorus girl, longed to be clever as she saw cleverness around her. After passing through a significant change of attitude toward life in which she sensed the relation of each individual to the race, she arrived at a great thought. One night she heard one of the girls of the chorus recounting a rather questionable experience of the evening before. It brought forth to Gloria's mind this contemplation: "Four thousand generations have kept the light burning for her, and now she's letting the wick go sooty like that."

The Problem of Health and Ideals.—It is important to

[1] Weston, George: The Salt of the Earth, Saturday Evening Post, November 30, 1918.

emphasize the fact that the problems of hygienic living touch the whole of life. Hygiene cannot be considered in water-tight compartments. The control of appetite, the development of habits, the selection of preferred forms of recreation are shaped by ideals. It is also important to emphasize that ideals must give rise to habitual attitudes. The way one responds today determines pretty largely the way one will respond tomorrow to the same situation, other things being equal. The power to show control in great moments is gained by the use of control in less significant times presenting like demands. Habitual response is the factor to reckon with.

Health habits are dependent upon laws of habit formation, and ideals, in the service of health and fine living, must act by arousing a definite attitude toward definite specified problems. An ideal of health as a quality of life rendering the individual fit to live most and to serve best will foster attitudes serving the individual and the group. Both must be served. Abundant life and generous service are the hope of society. Alone, either is worth very little.

A Social Ideal.—An ideal of social responsibility is the need of the times. Human conduct will be acceptable when the responsibility of the individual to society, to the past, and to the future for the whole of life has been met. Such an ideal of social responsibility is the need of education today. Communities and states and even the nation itself must reorganize education spiritually. This does not mean merely new attention to forms of worship, but it does mean emphasis on the religion of service for the common weal and a standard of social honor that puts the health and happiness of all first, and the individual needs or desires second. It is a question of attitude or mood in which we are taught.

Galsworthy[1] suggests the same thought when he says: "Now the sole hope that the future may be better than the past or present centers around the possibility of substituting for that bankrupt ideal (maximum production of

[1] Galsworthy, John: Where We Stand, *Atlantic Monthly*, February, 1920, p. 173.

wealth to the square mile) the ideal of the maximum production of health and happiness; for whatever the fashion of our speech and the complexion of our thought, this is not precisely the same thing."

Again he says, "If there be a saving way at all, it is obviously this: substitute health and happiness for wealth as a world ideal; and translate that new ideal into action by *education* from babyhood up."

An ideal of social responsibility must be a developed ideal, the result of education in the home and in the school. It is not instinctive, although it arises out of the same soil that provides the instincts. The evolution of the moral sense is essentially the carrying over from one generation to another of the modes of actions, the typical responses demanded by an organized society and considered by one generation to be worth perpetuation in the succeeding one.[1]

In the lower animals there is no carrying over of moral codes and standards. Sacrifice of self for others, when it occurs, is an unconscious act; but in man such action, representing the finest expression of the moral sense, is conscious. Because man is conscious, a being of intellect, a fashioner of ideals, and because ideals are not inherited tendencies like the instincts, the teaching of ideals of social conduct is of tremendous importance for the welfare of the race, and is of more significance in race culture than mere legislative laws governing marriage, childbearing, and social behavior.

For the individual there is no essential conflict between what is good for the individual and what is good for the race. That program of living which is most wholesome for the individual is also most propitious for racial progeny.

An ideal of social responsibility strikes at the selfishness that leads to loss of health; it cuts right across the superficial and shallow in living and reaches down into the facts and truths of nature. In this sense it immeasurably enriches individual human life if values are not mixed. The woman who refuses to bear children because of some of the

[1] Conn, H. W.: Social Inheritance and Social Evolution, Abingdon Press, New York, 1914, p. 77.

personal deprivations and losses that come has retained her maidenly figure perhaps; she has not missed the regular sessions of her club; she has not interrupted the round of parties, entertainments, and amusements; but she has lost in very vital ways by substituting a lapdog for the human offspring. Ultimately, therefore, the motive of social responsibility enriches life if one only sees straight. For the selfish, vain, and indolent, for the cynic of social claims, for the social parasite, the values that mean racial improvement, racial vigor, rich racial inheritance are not very appealing.

On the other hand, human culture, human improvement, hygienic and fine living will be guided by values that root themselves in the nature of man as represented by the social evolution of the race. The growing social consciousness and sense of obligation to others that characterize man and mark him off from the lower animals is a fact of such importance that its full significance when applied to the problem of human culture has never been adequately emphasized. It is certain, however, that nothing very lasting will come out of the health movement so long as its appeal is selfish and directed merely at prevention of disease.[1] The spectacle of a nation having plenty of food and going without so that other nations could live was possible because of the great dramatic ideal presented by the World War. The continual dramatization in the schools of an ideal of race culture, of an ideal of social responsibility is a crying need of the times.

An Ideal of Social Responsibility Arises Out of the Nature of Life.—The ideal of social responsibility bears no false document of identity. It arises out of the very nature of life and human society. It serves faithfully the origin, development, and purpose of human life, because,

1. Each individual is a link in the entire chain of life,
2. Each individual is an heir to an inheritance of life, both biological and social, and by the same token each individual is a trustee of the same goods for posterity, and therefore,

[1] Paton, S.: Human Behavior, pp. 160–212, Charles Scribner's Sons, New York, 1921.

3. Each individual is responsible for the preservation of the quality of life received from ancestral stock and with other members of society, for the preservation of the social environment conducive to health and happiness. Moreover, this responsibility implies not only preservation of life and opportunities received, but whenever possible progressive improvement. Health as a quality of life challenges each individual to make that health finer, richer, more complete, and abundant; it challenges men and women to preserve wholesome opportunities for living and to make them increasingly more abundant and useful.

To make clear the full implications of the above statements is a matter of importance.

Each Individual Is a Link in the Chain of Life.—If we trace life back through the countless ages of the past we find one fundamental fact of nature. The impulse of life, of living matter represented in each individual, is an impulse forging for the period of that one's life a link in the chain of all life.[1] So numerous are the links and so varied the chain that one is inclined to consider one's life as the beginning and end of the life one represents. Such is not the case. The individual represents many forces that have worked in the lives of his ancestors, and in a way he represents a mosaic of them. If it is a beautiful mosaic, it is strongly incumbent upon him to preserve its lines and colors, and if possible to so care for this inheritance that it will be improved with age. Such an inheritance one should value more highly than the inheritance of a silver spoon in the family for generations, or a social position attained by chance and held with difficulty.

On the other hand, if the mosaic be cracked, here is an obligation indeed. It must not be injured more, and if possible the defect should be remedied. Such an inheritance may be improved by proper living; perchance, by proper marriage the defect may not be so marked in the next generation. In any case, in the field of human life,

[1] Bergson (Henri), in his Creative Evolution, expresses the thought given here. He elaborates and develops it in a most satisfying way.

there is a wonderful laboratory for the performing of experiments in which there can be adequate controls, sufficient guidance, and definite records.

Each Individual Is an Heir to the Inheritance of Life.—It is only a step from the appreciation of the fact that the individual is a link in the chain of life to the comprehension of the importance of this fact for a generation and a nation. We, citizens of these United States of America, today are laying the foundations for the life of those who shall live in our places and do the work we have been doing. We have been concerned recently with keeping liberty alive in the world, with preserving the unity of this nation, with making "the world safe for democracy."

We have preserved our liberty and our unity, we have helped to emphasize the ideals of democracy, but it is also important that we assign to our heirs not only freedom from political slavery but also freedom from the ravages of disease; not only freedom from aggression by an arrogant military power but also freedom from insidious drains on our vitality.[1]

Responsibility for Life.—Acceptance of the biological relatedness of men and women[2] and the inheritance of life possibilities lead logically to a standard of social responsibility. *To live most and to serve best* is to recognize this standard. But the sense of responsibility for others must not become a meddlesome habit of benevolent paternalism. The individual must achieve health and happiness; they are not to achieve him. The control by organized society should be exercised only to protect the majority in matters approved by the majority. Members of society who cannot respond to approved standards of living either must be helped to respond acceptably or made harmless to prevent the realization of effective living by others.

Autocratic principles in the service of others suffer in a modern world the fate of autocracy everywhere. But

[1] Williams, J. F.: The Health Problem from a New Angle, *Educational Review*, January, 1920. McDougall, W.: Is America Safe for Democracy? Charles Scribner's Sons, New York, 1921.

[2] King, H. C.: Rational Living, The Macmillan Co., New York, 1914.

where control is clearly needed and clearly sanctioned, as in communicable diseases, purity of food and water-supply, sanitation of public places, care of excreta and garbage, there should be no half-hearted acceptance of the responsibility. Such administrative control should be accompanied by educational efforts to sanction and secure the gains for the group.

Ideals are not always immediately achieved. Woodrow Wilson went to Versailles in 1918; the Washington Conference was held in 1921; the Geneva Protocol was written in 1924; the Pact of Paris was signed in 1929. To work toward ideal and intelligent controls that will overcome superstition, ignorance, and the unworthy instinctive impulses in man is the path to progress. But inability of any group to rise to the heights of idealism involved in the solution of a problem may make it necessary for the Federal Government to step in and protect the individual as an asset of the state. With the Government the holding of ideals is just as valuable as for the individual. It is important to state, however, that ideals exist for government in proportion as they serve to guide the people of a nation. We call this force that shapes laws and regulations public opinion. Public opinion is forceful, it is powerful, and yet it is so simple that when once the people of the nation find themselves holding with conviction an opinion, an ideal, in a very short time it is translated into law.

It is conceivable, therefore, that an ideal of social responsibility may become so forceful in individual lives, and a conviction concerning human duty may become so strong, that there will result not only improved personal living but also more effective sanitary control of disease, more thorough and complete health work in the schools, desirable improvements in housing laws and regulations, increased protection for workers in hazardous trades, and better methods for controlling the appalling death rate of infants. Ideals should mean more and not less health; more and not less happiness.

An Ideal of Social Responsibility Serves All.—The ideal of social responsibility involves no real hardships, but it

presents no royal road. It will always lead the way to new accomplishments, sometimes by new roads through unbroken ground, sometimes by connecting old pathways. It will doubtless help to correct some prevailing attitudes. For youth and for old age happiness is held in high esteem, and for some an ideal of responsibility to society smacks of all that is destructive of happiness as they know it. These foolish ones think of happiness in terms of dance halls, horse races, and lobster palaces. They spend their energy to produce wealth with the avowed purpose of buying amusement which they call happiness. They miss the subtle fact that happiness cannot be bought, that it cannot be conferred; that it must be earned, it must be won. Though they travel over the earth to find happiness, they will miss it unless they carry it with them in their hearts. Happiness, like health, flows from life as a by-product of activities that are worthwhile and satisfying.

But for both youth and old age, an ideal of social responsibility may have real meaning. To the youth, able biologically to preserve and to pass on to future generations desirable human qualities, such an ideal comes as a challenge that he may accept, knowing that he will need all that he possesses of fortitude and courage. To the one who has passed the meridian of life the appeal is concerned chiefly with the influence of living that is to be exerted and with the preservation of the best treasures of the social inheritance. Custom, tradition, the *mores* of the people are powerful forces determining largely the kind of response that posterity will give. Social inheritance is as important as the facts of organic heredity.[1]

For both young and old, such an ideal will quicken and give meaning to life. Both may become interested in passing on an inheritance, biological or social, that shall be a fulfilment of trusteeship. To bequeath to immediate or distant offspring biological and social jewels is incomparably superior to the oft valued bequest of battered silver spoons, pewter plates, or old clocks.

[1] Huntington, E.: Civilization and Climate, pp. 35–48, Yale University Press, New Haven, 1915.

The Significance of Social Pressure in Relation to Ideals.—Ideals vary. Some persons have many, some have none; and no one is compelled to hold any particular ideal and no one can force an ideal upon another. Ideals are achieved; they belong; they can never be legislated into being nor made to live by edict or pronouncement. And just because this is so we shall have need often to remind ourselves of this variability in human beings. In such fashion we shall want to reinterpret that hallowed phrase of the Declaration of Independence that "All men are created free and equal." Now, the facts are just the opposite. Persons are not equal at all. They have varying capacities for growth and development. In a sense we are equal before the law, but to say that political equality alone is meant begs the question, since "I am just as good as you are" accurately depicts the common attitudes on equality. It ought to be quite clear that equality is not conferred nor provided by government. Equality, like so many precious things in life, must be won. The only test is that of worthy achievement.

Since ideals cannot be compelled, but must be won, since equality cannot be conferred, but must be achieved, since happiness cannot be bought, but must be earned, since all the worthwhile things of life come from living in the right way, it is important that society be careful to provide for each individual the most appropriate and best life opportunities possible. Such provision may require social pressure by the group.

In speaking of the aims of education—some might call them ideals—Thorndike[1] with characteristic clearness describes the way social pressure is commonly exerted. He writes:

"No one is compelled by any inner necessity to accept as his aim in education for himself or his fellow-men the improvement and satisfaction of human wants—the cultivation of a good will, impersonal pleasures, knowledge of things and men, habits of open-mindedness, and physical and mental efficiency, and only the best individuals do

[1] Thorndike, E. L.: Education, p. 14, The Macmillan Co., New York, 1912.

accept these aims. Fagin tried to debase Oliver's wants and to satisfy his own at the cost of everyone else's. Manufacturers may try to fit the children of a community to be nothing save efficient workmen. Baptists may plan their schools in utter defiance of Methodist and Presbyterian wants. A parent may count the satisfaction of his child's vanity above the satisfaction of a hundred other children's rights.

"Social pressure is required to prevent folly and injustice in education as elsewhere. Fagin can, if he likes, consider no wants save his own, but all men acting together can, if they like, hang him therefor. Parents may, if they like, consider no wants save their child's, but other families can have that child expelled from the school, or the parents from the community. Manufacturers can vote to take money from high schools for trade-schools, but others vote also. The state can suppress sectarian schools altogether if it thinks that an unfair discrimination among wants is made by them."

Ideals are essential for the realization of the best in life; they are, therefore, essential for all living. They are, in the intelligent life, well supported by truth, by the facts of life. They keep their feet on the ground. They do not confuse the *ought* and the *is*, but by using the materials of life they seek constantly to achieve higher levels.

QUESTIONS AND EXERCISES

1. How is human conduct determined?
2. State McDougall's three stages in human conduct.
3. By a series of illustrations, show that education, religion, and society are largely influenced by the second level.
4. Present evidence to show that the second level is not in accord with the modern educational idea of self-direction.
5. What cautions are to be kept in mind in upholding ideals as a control of conduct?
6. Contrast the force of instinct and intellect as a guide in health conduct.
7. Give specific evidence showing that instinctive guides are unsafe in the matter of health responses.
8. Show the relationship between intellect and ideals.
9. What implications are involved in the ideal "to live most and serve best"?

10. Show that an ideal of social responsibility is the need of the times.

11. Cite evidence which shows the responsibility of the individual to the members of society.

12. Enumerate the health outcomes which may be realized through individuals who have dynamic social ideals.

13. Show the significance of social pressure in the shaping of ideals.

14. State specifically the procedure you would follow in establishing health ideals.

CHAPTER IV

THE APPROACH FOR KNOWLEDGE OF HEALTH

I. The Science of Hygiene Is Based on the Facts of Man's Nature.
II. The Biological Basis of Life.
III. Evidence from Biology a Guide for Hygiene.
IV. The Human Body and Its Adjustment.
V. The Human Body an Energy Mechanism: Sources of Energy.
VI. The Value of the Biological View.
VII. The Test of Hygienic Knowledge.

The Science of Hygiene Is Based on the Facts of Man's Nature.—In order to understand the kind of food best suited to man, the needs of the physical organism, the way in which the mind works, the manner in which bacteria and parasites grow in the body, it is necessary to know the kind of organism the human body is, its mode of development from lower forms of life, its origin from those forms, and the way in which environment has molded and controlled the development of the body. The science of hygiene must, therefore, be based upon the knowledge of the nature of the human organism if it is to be something more than tradition, custom, and superstition. It is interesting in this respect to remember that the beliefs of many peoples regarding the care of the body are not scientific, and in proportion as they are merely traditional they are of less value in producing hygienic living. Beliefs among the more ignorant Negroes, the peasant Chinese, the wild tribes of Borneo and the Philippines (Fig. 12) instance the influence of superstition as a guide in living. The ignorant Negro will give more credence to a superstitious belief, as a rule, than to a scientific viewpoint. This is due to the comparatively short period this race has been in contact with forces of education. It is interesting in this connection to note that Negroes in college and university, representing as they

Fig. 12.—Certain groups of Filipinos believe that a band like the one illustrated here will keep away smallpox and other diseases. This band is called an anting-anting.

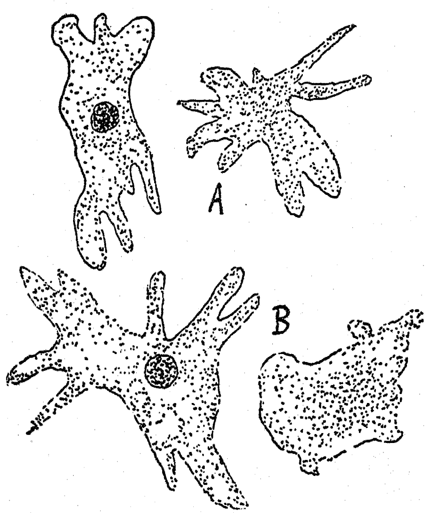


Fig. 13.—An ameba, a simple unicellular organism: *A*, An ameba divided into nucleated and non-nucleated portions; *B*, the same portions after an interval of eight days. (After Hofer.)

do the highest types of their race, accept and practice as faithfully the dictates of science as the more socially favored white races.

The Biological Basis of Life.—To understand man's nature it is essential to know the biological basis of man's life, and the way in which he attained unto the kind of being he is today. The simplest and lowest forms of animal life are illustrated in the amebas. These are single unicellular organisms and represent in structure the units of structure in the human body (Fig. 13). As life evolved higher forms we see at a higher level the group of animals called the Coelenterata, examples of which are hydras, sea-anemones, jellyfishes, and coral animals. They are so called because they are distinguished by having a coelum, or body cavity, which serves as a digestive sac. Such tissues as nerve and muscle are not present, or very poorly developed, and the systems of circulation, respiration, and excretion are entirely absent, although the functions of these systems are carried on.

At a still higher level in the scale of development of life-forms emerges the type illustrated by the lower flatworms. Here for the first time appears muscular tissue in significant amount. The muscles are arranged in circular and longitudinal fashion around the trunk of the worm and serve for locomotion.

The appearance of the muscular system increased the range of locomotor activity for the animals so endowed; it made possible a richer environment; but it required marked specialization of the body cells. In proportion as the muscle cell gained ability to do specialized work it lost ability to care for all the processes that are required in living tissue.[1] This specialization of certain cells required that other cells take up the work of supplying the muscle cells with food and of removing the waste occasioned by their activity. Thus it is that special cells appeared to furnish the food and oxygen needed by the muscles, and other special cells took unto themselves the work of remov-

[1] Bigelow, M. A. and A. N.: Introduction to Biology, The Macmillan Co., New York, 1913, Chap. II.

ing the waste. This is the beginning of the circulatory and excretory systems.

Professor Tyler[1] expresses this change when he says, "We must never forget that the development of the muscular system carried with it, or dragged after it, the development of our most important viscera, kidneys, lung, heart, and blood-vessels and, as we shall see later, of the brain itself."

The contraction of muscle is dependent upon a stimulus that will cause it to act so that muscle cells required the addition to the very simple nervous system of corresponding nerve fibers. The increased power of locomotion brought the animal into new environment and new situations, and from now on through fishes, reptiles, lower mammals, as the cat and dog, arboreal mammals, as the ape up to man, the whole history of the developing life is the history of an increase in complexity and function of the nervous system. The brain, as the final and most complex structure to develop, presents an organ of wonderful usefulness to man. It exercises control over the other centers of the nervous system and hence over all the parts of the body. Part of this control goes on without the knowledge of its action on our part and irrespective of our will in the matter. It is impossible to make the heart stop beating by thinking or to make the liver secrete bile by reading about it. This control over the vital organs of life is automatic and involuntary, and although we know conditions that would modify the type of reaction that occurs, we are limited greatly in an effort to guide the response. We have through the development of consciousness and the will a certain power over the muscles of the body and, in accordance with the way in which the organs of the body arose, we are able most effectively to reach their processes through the action of the skeletal muscles of the body.

The outline given here aims to be brief, and yet the facts are so important that they must be adequately stated. For this purpose we quote Tyler[2] again:

[1] Tyler, J. M.: Growth and Education, Houghton Mifflin Co., Boston, 1907, p. 26.
[2] Tyler, J. M.: *Loc. cit.*, p. 38.

"The human body is composed of many distinct systems and organs, all indissolubly united in one organism, where 'every part is at once means and end to every other part.' The health and life of the whole organism may be disturbed or destroyed by the weakness of any one of these numerous parts. What we often call the lower organs, the viscera, are absolutely essential to life, and hence by far the most important. They are fundamental as well as essential. Anything which disturbs our digestion or the removal of waste equally disturbs the clearness and vigor of our thought. Every part must be of the highest possible efficiency. One great aim of education should be to 'make the weakest part as strong as the rest.' If there is to be no schism in the body the organs must be properly balanced in weight and power. Otherwise the overgrown part robs some other organ of its fair share of nutriment, and throws upon it burdens which it cannot bear. If any part is, for any reason, to be exposed to excessive strain, that part must be fortified and strengthened during its period of growth in early life. But every other part should be correspondingly strengthened to back it up in its emergency.

"It is hardly possible that in so complex a being as man all parts and organs should develop with equal rapidity at one and the same time . . . We should expect to find that there is a special time for the rapid development of each organ. We should naturally expect that the more fundamental organs, like those of digestion, excretion, and respiration, will develop early to meet the needs of other growing parts, and that some will be held back to give time and opportunity for this important process.

"We cannot fail to notice the immense amount of time devoted by nature to the development of the muscular system. Why did she linger so long over it before going on to the development of the brain (Fig. 14), especially of the cortex, with its mental powers? Evidently it must be of far greater importance and have far larger latent capacities than we have usually supposed. The muscular system is the strategic center, so to speak, from and through which we can reach, exercise, and strengthen the intestines, lungs,

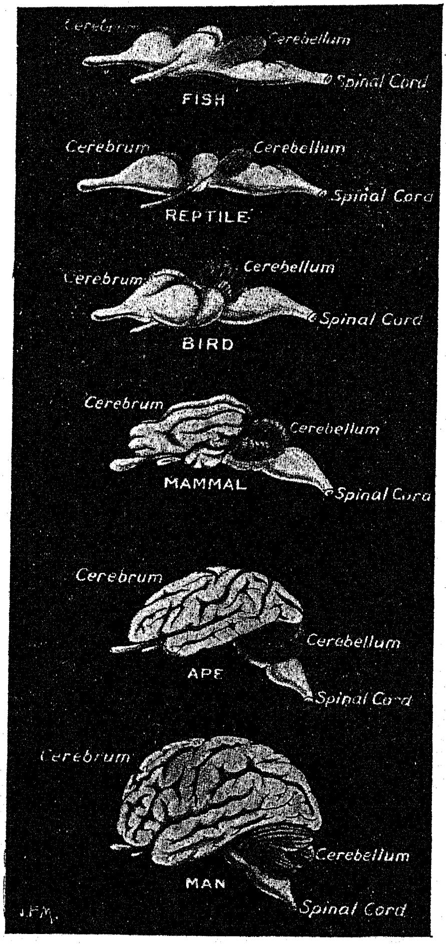


Fig. 14.—This drawing shows the development of the brain from fish to man. The cerebrum, the seat of intelligence, increases in proportion to the other parts. In mammals it becomes more and more convoluted. The brain, which lies on one plane in fishes, becomes gradually curved on itself. In birds it is more curved than the drawing shows. (Thompson.)

kidneys, and all the organs essential to life, but which are beyond the direct control of the will. Hence the sturdy vigor of our ancestors and the dangers of a sedentary life.

"We have found that different portions of our muscular system have arisen at different ages, and that they grow younger as we go out from the trunk to the ends of the fingers and downward to the toes. The central and fundamental are older than the peripheral and accessory."

Professor Tyler describes how these muscles are controlled by nerve centers, and explains that the centers in control of the muscles of the trunk are older, tougher, and have more endurance than those of the muscles of the extremities. To quote him[1] again:

"Therefore we are not surprised to find that the best physiologists insist upon the fullest possible development of these fundamental centers. They are the seats of endurance which enable us to hold out against the strain of modern life, especially in the hurry and fret of our great cities. They must be strengthened at all cost in the children of parents who show any signs or traces of nervous weakness, in all the children of the business and professional classes, and in those children who will later enter these lines of work. The high-strung American girl needs this preventive and developing treatment more than any other form or kind of education. No child can have too much of it, and in every case it is far better to have full enough than too little."

Evidence from Biology a Guide for Hygiene.—It is of very great importance to point out that the digestive system developed in relation to needs arising in the body, chiefly the needs of the muscles. It used food that was altered little before digestion. However varied in kind the food was among different races of man, it nevertheless retained in all a prevailing coarseness and simplicity. Civilized man has changed both his physical life and the character of his food supply. It will never be possible for him, as he is constituted, to live an essentially vigorous life and digest his food with ease and efficiency, without a wholesome participation in physical activity and without

[1] Tyler, J. M.: *Loc. cit.*, p. 41.

the use of natural food. A good deal of discomfort and lack of appreciation of the problem of feeding the human man would be avoided if this simple principle were understood and acted upon. It is interesting to read what James[1] says regarding the development of a type of man that will not require a strong muscular system and will be free from adequately chewing coarse wholesome food. His description of this type follows:

"I recollect years ago reading a certain work by an American doctor on hygiene and the laws of life and the type of future humanity. I have forgotten its author's name and title, but I remember well an awful prophecy that it contained about the future of the muscular system. Human perfection, the writer said, means ability to cope with the environment; but the environment will more and more require mental power from us, and less and less will ask for brute strength. Wars will cease, machines will do all our heavy work, man will become more and more a mere director of nature's energies, and less and less an exerter of energy on his own account. So that if the *homo sapiens* of the future can only digest his food and think, what need will he have of well-developed muscles at all? And why, pursued the writer, should we not even now be satisfied with a more delicate and intellectual type of beauty than that which pleased our ancestors? Nay, I have heard a fanciful friend make a still further advance in this 'new-man' direction. With our future food, he says, itself prepared in liquid form from the chemical elements of the atmosphere, pepsinated or half-digested in advance, and sucked up through a glass tube from a tin can, what need shall we have of teeth or stomachs even? They may go along with our muscles or our physical courage, while, challenging even more and more our proper admiration, will grow the gigantic domes of our crania, arching over our spectacled eyes, and animating our flexible little lips to those floods of learned and ingenious talk which will constitute our most congenial occupation."

[1] James, W.: Talks to Teachers on Psychology, H. Holt & Co., New York, 1918.

Contrariwise, the future of *homo sapiens* will depend neither upon his ability to do without exercise nor to subsist upon tablets of food elements, but rather upon his ability to harmonize the demands of his biological nature with the requirements of civilized life.

Professor Snedden[1] has pointed out some of the significant changes in civilization that bring to the biological organism serious demands on its adjustment capacity. He says that man

1. Early took on erect stature and ceased vegetarianism.
2. Disposed of hair and took on clothing.
3. Ranged the world and assembled many kinds of pathogenic bacteria.
4. Took to work which overtaxes eyes and nerves.
5. Developed much "sitting," thus encouraging insufficient use of torsal structure.
6. Developed concentrated and cooked foods, thus encouraging partial atrophy of teeth and jaw structure.
7. Developed means of artificial heat, thus reducing climatic stimuli.
8. Lives much under cover, thus reducing stimulating or chemical values of air breathed.
9. Has postponed marriage, thus imposing a period of severe sexual strain between sexual maturity and time of approved marriage.
10. Has developed routine toil instead of the intermittent work of the ancestors.
11. Has made of some men (formerly) and many women creatures of decoration rather than useful social functions.
12. Has substituted for the close concrete fears of the primitives the "long range" intellectualized apprehensions and solicitudes (worries) of provident life.

It is not important to agree with all of these suggested changes, but it is important to *understand* that modern life has thrown upon the biological organism severe strains (Fig. 15), and to understand further the fundamental needs for the preservation of the health and vigor of the body.

The Human Body and Its Adjustment.—The biological evidence indicates that man's development has brought an inheritance of structure and function that requires thoughtful care and attention by the individual and society to devise ways and means of meeting the artificial conditions

[1] Unpublished lecture delivered in Summer Session, Columbia University, 1921.

imposed by civilization. The experience of man indicates everywhere that the fundamental biological needs cannot be ignored. Fortunately, the increased interest in health today is helping to overcome some of these environmental handicaps. One may be the veriest tyro in hygiene and yet know of the efforts everywhere to combat the dangers that Snedden suggests. The interest in posture, the era

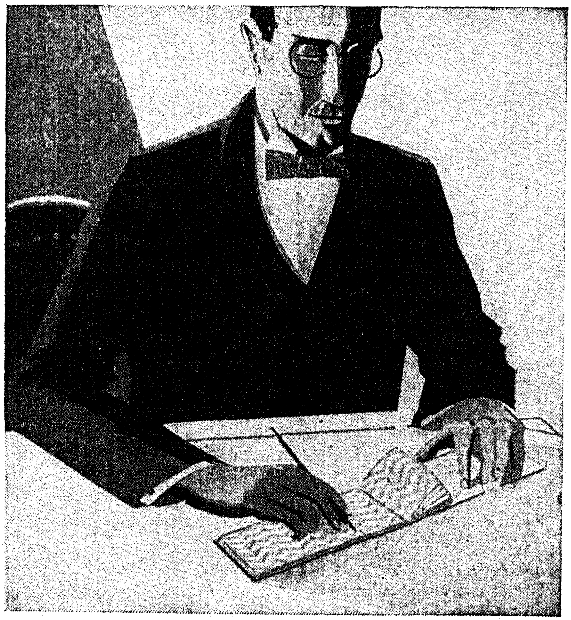


Fig. 15.—Sedentary work is an occupational health hazard. (Saturday Evening Post.)

of wholesome dress, the development of serums, the establishment of isolation measures, the play and recreation movement, the crusade against the sedentary life, the agitation for coarse, wholesome food, the open air and camping programs, the keen interest in and study of social hygiene, the emphasis on the importance of physical work, the recognition of athletics for men and women both, the de-

velopment of instruction in mental hygiene—all attest to the appreciation of the problems presented by civilized life. It is most fortunate that these movements are adjustive, that they are based on biological needs, and are not trying to develop a type of man like the one to which William James has referred. Many of the false standards of civilization with their emphasis on the maximum production of wealth will be changed. The biological adjustment will be made easier with the advent of more rational attitudes.

The Human Body an Energy Mechanism.—The ability of the body to adjust itself to new situations as well as to function properly in old and familiar ones is related to its ability to release and use energy. The individual with abundant energy may not always meet the problems of living satisfactorily either from a personal or social viewpoint, but surplus energy is a necessity for the best volitional control and, hence, for rational action. Its release and expenditure determine largely man's ability to adjust to the various problems presented in complex modern life. The energy aspects of life are set forth clearly by Osborn:[1]

> So far as the creative power of energy is concerned, we are on sure ground! In physics energy controls matter and form; in physiology function controls the organ; in animal mechanics motion controls, and in a sense creates, the form of muscles and bones. In every instance some kind of energy or work precedes some kind of form, rendering it probable that energy also precedes and controls the evolution of life.

For a long time the body has been considered as an organism with ability to receive, store, and express energy. The manifestations of life in action have always appealed as energy manifestations, but the known and unknown chemical reactions going on in the body, while seemingly on an energy basis, have never been fully understood. The phenomena of growth and development have always been obscure even when we had information about hormones and the power of certain internal glands to control the metabolic changes going on in the body. It is extremely valuable to set forth the way in which this control is exer-

[1] Osborn, H. F.: The Origin and Evolution of Life, Charles Scribner's Sons, New York, 1919, pp. 10, 11.

cised. Osborn says, "every physiochemical action and reaction concerned in the transformation, conservation, and dissipation of energy produces also, either as a direct result or as a by-product, a physiochemical agent of interaction which permeates and affects the organism as a whole or affects only some special part."

By an agent of interaction is meant a force connecting the force of action and reaction. It refers to what is going on between parts and is similar in type to the interaction between a driver and a driven horse by means of the reins. A nerve impulse in this sense is an interacting agent, since it connects the action of a distant nerve cell with the response of a muscle in vigorous contraction. A hormone produced in cells in one part of the body and passing in the blood may affect the activity of cells far remote. Osborn[1] goes on to say:

> Through such interaction the organism is made a unit and acts as one, because the activities of all its parts are correlated. Since it is known that many actions and reactions of the organism—such as those of general and localized growth of nutrition, of respiration—are co-ordinated with other actions and reactions through interaction, it is but a step to extend the principle and suppose that all actions and reactions are similarly co-ordinated; and that while there was an evolution of action and reaction there was also a corresponding evolution of interaction, for without this the organism would not evolve harmoniously.

To quote Osborn[2] again, "Evidence for such universality of the interaction principle has been accumulating rapidly of late, especially in experimental medicine and in experimental biology."

The experiments of Morgan and Goodale bear this out. Loeb,[3] in his stimulating book, Forced Movements, Tropisms, and Animal Conduct, shows the evidence from the biological laboratory. The actions of animals are determined by the influence bearing upon the many sensory receptors. The response to the stimulus is determined by the energy available (Fig. 16). These facts mean for those

[1] Osborn, H. F.: *Loc. cit.*, p. 16.
[2] *Ibid.*
[3] Loeb, J.: Forced Movements, Tropisms, and Animal Conduct, J. B. Lippincott Co., Philadelphia, 1918.

who would live most and serve best that energy should be abundant at all times as a guarantee of the best adjustment, the best choice.

It should be noted further that the tissues and organs of the body are especially adapted to receive, store, or express energy. This characteristic is especially valuable, for it enables a balance and control to exist in the body

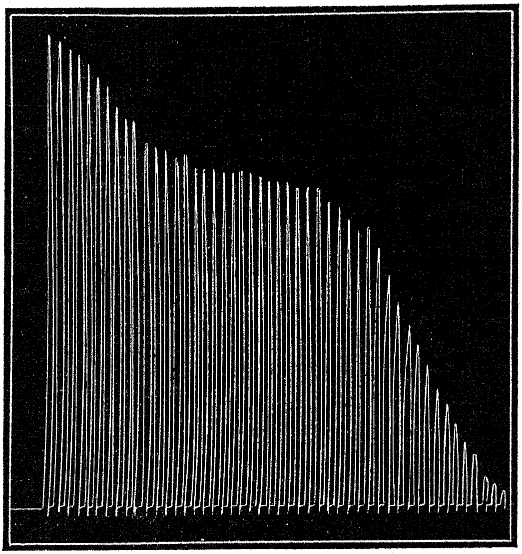


Fig. 16.—When the energy is low the response is less. This is well shown in fatigue. Above is illustrated a normal fatigue curve of the flexors of the middle finger of the right hand; weight 3 Kg. and contractions at intervals of two seconds. (Maggiora.)

without which there would be no harmony either in development or in action. Osborn[1] again states this point in excellent phrase:

All visible tissues, organs, and structures are seen to be the more or less simple or elaborate agents of the different modes of energy. One after another of the special groups of tissues and organs are created and co-ordinated—organs for the *capture* of energy from the inorganic environment and from the life environment, organs for

[1] Osborn, H. F.: *Loc. cit.*, p. 17.

the *storage* of energy, organs for the *transformation* of energy from the potential state into the states of motion and heat. Other agents of control are evolved to bring about a harmonious *balance* between the various organs and tissues in which energy is *released,* hastened or *accelerated,* slowed down or *retarded,* or actually arrested or *inhibited.*

The method of energy manifestations is being gradually explained and understood. We are beginning to understand that all actions and reactions, dependent for their power upon energy, are coordinated; they control and modify the organism in accordance with the influence that the particular actions give. This gives us the scientific background for the teaching that our actions today determine in a very definite way the kind of response we will give tomorrow. This has been stated by Bergson[1] and some time ago by James. James says[2] in this connection:

"What he shall *become* is fixed by the conduct of this moment."

Energy plays an important part here, especially in all ethical situations. To quote James again:

"The ethical energy par excellence has to go farther and choose which interest out of several, equally coercive, shall become supreme."

Thus energy, abundant energy, lies at the very root of life. It fixes largely the choices made; it qualifies the vision. Only with abundant energy coordinating the body functions is the immediate thrusting appeal of the moment turned aside for the distant view, the higher goal.

The more recent studies in medicine, biology, physics, and chemistry indicate, therefore, that the human body is not to be thought of as an aggregation of cells and organs that act irrespective of the control afforded by an interacting mechanism, but rather should it be considered a unified whole, guided at times by a circulating substance in the blood, at other times by an impulse from nerve cells. There may be other ways in which the control and balance of the body are maintained, but at present we are familiar only with these forms. The human body, like all bodies

[1] Bergson, H.: Creative Evolution, H. Holt & Co., New York, 1913, pp. 34, 35.

[2] James, W.: Psychology, H. Holt & Co., New York, Vol. i, p. 228.

for that matter, is an energy mechanism. It acts without reference to its size and is, except in the case of some muscular actions, not dependent upon its size. The amount of released energy in the individual is dependent more upon the activity of his nerve tissue and the character of his internal secretions than upon his height or weight. The human body is dependent upon the same food sources for energy that serve the other animals, and the availability of these sources controls in large measure the amount and character of the energy expressed in the life of the individual.

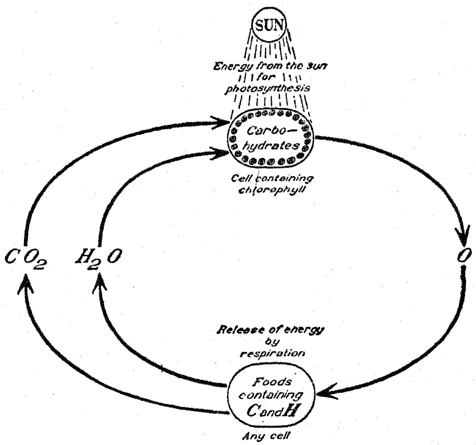


Fig. 17.—Storage and release of energy. (From Peabody and Hunt, "Biology and Human Welfare." By permission of The Macmillan Co., Publishers.)

Sources of Energy.—Ultimately the source of all energy for man is the sun, according to the theory of photosynthesis. Lavoisier and de Saussure laid the foundation of the understanding that the action of solar heat and light is a perpetual source of living energy. But for man it is perhaps equally important to recall the following conception of the cycle of elements that passes through plants and animals. The animal is sustained by the plant and the plant, in turn, is dependent upon the animal for the

waste that forms the source of certain essentials in plant metabolism. The energy of the sun is captured by the plant through the chlorophyl and is stored in food (Fig. 17).

The plant with chlorophyl is able through the action of the solar energy to form carbohydrates. In addition, fats and protein are manufactured in the plant and mineral compounds are absorbed from the soil. The chlorophyl action is very interesting. The leaves of the plant with chlorophyl in the presence of sunlight separate carbon atoms from the oxygen in the molecules of carbon dioxide (CO_2) and hydrogen atoms from the water (H_2O), storing up the energy of the hydrogen and carbon products in the carbohydrate substance of the plant.

In this way the starches and sugars of the plant deposit their stored energy in the tissues of the plant. Such energy is available for the animal and will be released to the animal by the addition of oxygen in the cells. This is an important fact, that the energy of food requires oxygen for its utilization and will be released when oxygen is brought in contact with it. It is thus seen that the energy of the sun transformed into the chemical potential energy of the elements, carbon, hydrogen, and nitrogen, is transmitted by the addition of oxygen in the animal into motion, heat, or functional activity of glands.

The sources of human energy, therefore, are the plants and oxygen. Other animals serve to yield food energy for man, but they, in turn, are dependent upon this same source. An understanding of simple plant physiology, therefore, frees us in part from the exigency of attributing to a mysterious power the phenomena of growth, development, and action.

But are there other sources of human energy than those involved in the chemical action and reaction that approximates the test tube experiment, and are we left in a hopeless materialistic position if we are unable to attribute to a Supreme Power the actions of life and the phenomena of growth and development? In many ways we are immeasurably enriched, because we are not acting on supposition,

but on fact as determined by experiment.[1] We have no need to postulate mysterious forces either to explain man's action or to interpret the record of his growth. The mechanisms[2] available in man and sensitive to the changing situations in life are capable of releasing energy at moments of great demand. Proper attitude toward any situation will result in the proper response, and for this response the whole of life is prepared to act.

It is important to state, therefore, that we have no evidence that there is any force acting on the body to determine its response except as it acts by stimulating the varied mechanisms of the body. Thus any situation that produces a state which is called emotion also produces profound internal changes in the body which are a part of the response. The enormous strength exhibited by man under the influence of a situation provoking the external signs of fear or anger is not due to any force that has entered the body, but to a group of internal changes characterized by a free release of energy that was present in the body all the time.[3] A Supreme Power does not act by bringing some force into the body, but through our response to situations of stimulating character we may be aroused to release in any particular effort more than we habitually expend. As Herrick[4] says, "The energy all comes from the outside, but the product depends upon what is inside," and the energy comes from food. The response depends of course upon the kind of mechanism. The changes in the ways of responding are the characteristic of each individual. All persons do not use their energy to produce similar patterns of behavior. Most people have little appreciation of the tremendous power they possess, and many people spend their whole life without at any time calling on those great energizing mechanisms which result

[1] Conklin makes an excellent statement of this view with reference to development of the body in Heredity and Environment, pp. 43–51.
[2] Cannon, W. B.: Bodily Changes in Pain, Hunger, Fear, and Rage, D. Appleton & Co., New York, 1916.
[3] *Ibid.*
[4] Herrick, C. J.: The Thinking Machine. The University Press, Chicago, 1929, p. 299.

in great achievement. A corollary of this is that most people never live up to the highest level of their best, and, as a rule, fail to appreciate what health, happiness, and love really are. We can hope for a great increase in effective living when more people bring into their lives the powerful and stimulating forces which enable them to release and transform energy that the body possesses into the doing of a really important work and the living of a really effective life. The strongest and most powerful forces in this respect are ideals of service. If the ideal of social responsibility really belongs to one, its value will be seen in real achievement.

The health of a man and his best welfare cannot be determined by a mechanical or materialistic test. In the working out of any scheme for the development of the best in the individual full appreciation must be given to those indirect factors that profoundly influence the conduct of the individual and that always determine results in the final analysis. The human mechanism, while made up of organs and cells that receive their energy from the sun through the plants in the same way that cells in other animals receive their energy, is in man nevertheless subject to a different kind of control. It will be important to keep this point in mind because the solution of many of the problems of living is dependent upon an understanding of the emotional and psychic factors involved in health, and the power of intelligence in maintaining health. "What we wish to insist on is that man's intelligence is a fact, that it is immensely and in effect immeasurably superior to the intelligence of the lower animal, and that this intelligence can become the significant guiding factor in man's conduct."[1] The realization of the essential chemical character of man need never exclude an appreciation of the fact that this chemical character is one that is controlled by a nervous system that has given to us intelligence and ideals, both a promise of God in man.[2]

[1] Bergson, H.: Creative Evolution, Henry Holt & Co., New York, 1913, pp. 98–185.

[2] Thorndike, E. L.: Educational Psychology, Teachers College, New York, 1919, pp. 306–312.

The Value of the Biological View.—When it is recalled that exercise, food, air, rest, sleep, and bathing form a very large part of the subject matter of hygiene, we realize the value of looking at the body from a biological point of view. The story of animal life must never be forgotten. The primitive cell, as represented in such an animal as an ameba, is able to move, to gather and digest food, to take in oxygen and expel the waste, to rest and keep itself free from the poisons that would most readily injure it. This organism combines in one cell all the functions that man must care for in different systems of the body, but man is just as dependent as this cell on the effective workings of these functions. This fact should never be forgotten. Unfortunately, it frequently is forgotten in the absorbing activities of the nervous system. But the nervous system itself is dependent upon these other processes for its very foundation and sanity, so that one can hardly hope to achieve any real and lasting success through the nervous system without caring in an intelligent way for the biological basis of life.

Let there be no misunderstanding on this point. He who would have health must work for it. Wishing for it will not achieve it; ideals without intelligent effort are dead. It is not something that can be bought at the corner drug store or achieved by unscientific processes. Health, strength, and vigor in any person is health, strength, and vigor of the vital organs of the body, including the nerve centers of the cord, and it should be clear and compelling that this strength comes largely from the use of the muscles of the body, and especially the trunk muscles in youth. If we would lay the foundation for health, strength, and power we must run, jump, climb, swim, and engage in play and sports that have engrossed man since earliest times. One need expect no real results by five minutes of formal exercise in the bedroom on retiring or by deep breathing at an open window. The way to health is the path of wholesome activity (Fig. 18). This implies something more than riding in street cars, eating prepared and predigested foods, breathing deeply for five minutes in twenty-four

hours, and working over long periods without reasonable time for rest, recreation, and sleep.

This emphasis upon the normal function of the vital organs and particularly the muscles should not be inter-

Fig. 18.—Helen Wills Moody making a low back hand stroke. Notice that the player is entirely off the ground. (Wide World Photos.)

preted to mean that mental or spiritual influences are of no avail. The whole of life decries such a view. Right attitudes, finding meaning in life, social motives and ideals in

line with the principle of interaction profoundly condition the functioning of the whole organism.

There need be no essential conflict between the demands of health and the demands of the intellectual and moral life. If health is not thought of as an end, but only as a means for the accomplishment of worthwhile work in life, no conflict will arise. That life which may be called "good" will be physically wholesome, mentally keen and fervid, and morally sound.

To have health and not to use it in socially serviceable ways is, of course, morally wrong. The man or woman who refuses to use health and strength for the accomplishment of service to society has no justification today. The two extremes are recognized here: the individual who fosters health for health's sake, and the one who loses his health in the effort to achieve a piece of work. Of the two courses, the latter is preferable. Professor Thorndike remarks in this connection:

"To some extent we barter our health for the other valuables—knowledge, skill, and habits of utility to the community. At present we probably sell too much of health, but it would be equally unwise to sacrifice everything for health. It is better to be a Socrates with a headache than a perfectly healthy pig. There must be a compromise."

The art of fine living consists of the greatest intellectual development and the most worthy social service possible, without loss of power to continue the race adequately, to enjoy life fully, and to be a real source of happiness to others.

The Test of Hygienic Knowledge.—The test of the usefulness of hygienic knowledge is to be found in its contribution to the art of fine living. A considerable amount of health advice and instruction has been made for individuals and provides no guide for all. Many persons learn some particular practice because a friend who was ill was advised by the physician to do thus and so. Any particular health advice must be made and upheld because it is of value not in healing the sick, but in keeping the well strong and happy, in preventing illness, and making the indi-

vidual more efficient and useful. The test of its value is not is it good for the sick, but is it rational and scientific for the well. The treatment of the convalescent is not the treatment of the vigorous man of affairs or the healthy teamster who may by hygiene become more vigorous and more strong.

Hygienic or health knowledge must apply to the whole of man. It is to be criticized as a system if it is effective only in neurasthenic states. The use of faith cures, or spinal adjustments, or the practice of abstaining from the use of meat, or the carrying of an onion in the hair for relief of headache, are partial, limited, and incomplete procedures. They may have special application in special cases. But confusion of special measures with systems must not be made. The few trees must never be taken for a forest; the few swallows, for a summer. The hygienic procedure that purports to possess universal characters must be viewed with suspicion. The life of man in his adjustment to the strains of modern life, in his hopes and aspirations, in his work, play, recreation, indeed, in his love and worship, is not to be guided by mystic formulae, nor to be saved by special methods. Hygiene is to be tested by its contribution to the whole of life.

QUESTIONS AND EXERCISES

1. Show what is meant by taking the biological point of view in the study of hygiene.
2. State specific reasons for taking the biological point of view in studying the human body.
3. What are the divergent points of view presented by the science of hygiene, tradition, custom, and superstition?
4. State implications involved in the knowledge that the muscular system dragged after it the development of the vital organs.
5. Enumerate a number of factors in present-day living which constitute hygienic problems.
6. "The future of homo sapiens will depend upon his ability to harmonize the demands of his biological nature with the requirements of civilized life." Elaborate.
7. Cite evidence to show that increased interest in health is helping to overcome some of the problems presented by civilized life.
8. Show that "our actions today determine in a very definite way the kind of response we will give tomorrow."
9. What is the source of energy in man?

10. What factors determine the amount of energy which may be released in the individual?

11. State specifically the relation of emotion to the release of energy.

12. Upon what factors are health, strength, and vigor dependent? State specifically the part activity plays in such development.

13. State the limitations of considering health as an end in itself.

14. Defend or refute the idea of "fine living" set forth in this chapter.

15. Show that hygienic knowledge must apply to the whole of life to be truly effective.

CHAPTER V

SCIENCE AND ATTITUDES

The Dual Aspect.—The problem of personal hygiene is dual. On the one hand, it involves science which provides us with accurate knowledge of the way in which to care for the body. On the other hand, it requires habitual attitudes which use this scientific knowledge in the service of ideals.

The laws of health are stated by science. They come from the food laboratory, biology laboratory, health departments, statistical bureaus, university departments of hygiene, organizations such as the American Public Health Association, Anti-Tuberculosis League, American Medical Association, Federal bureaus, such as the United States Public Health Service, and State Departments of Health. These health departments and bureaus for hygienic living test out the traditional and customary modes of living and serve as effective and authoritative sources for the determination of the values of any particular hygienic practice. The laws of health, if they are to serve as good guides, must be accurate and scientific, and at no time can they depend upon superstition and hearsay. A certain number

of people believe that rheumatism may be avoided by carrying in the pocket a red kidney bean. Such belief is probably founded upon the single experience of one man who carried a bean in his pocket and never had rheumatism. It is unnecessary to say how fallacious such reasoning is, and yet in more subtle and confusing arguments there is need to hold to the general tenets of scientific proof[1] of the value of any particular procedure. One of the responsibilities of the educated person is to refrain from being moved by superstition. Wisdom expresses itself in many ways; one way is by the use of scientific guides as distinguished from the occult, mysterious, and superstitious. "Education is the vaccination that confers immunity, but it does not always take."

The laws of health are given by science; the practice of them is a matter of habit in which ideals and attitudes have shared largely. For the best results in education health habits should never be automatic except in the routine care of the body. For meeting the complex, widely varying problems of human adjustment, the only safeguard is ideals of living that shall foster and strengthen desirable attitudes. The most scientific theory of correct living, made automatic, might succeed in an artificial environment, but for life in the present world it needs constant correction by intelligence and constant motivation by ideals.

The Way of Modern Science.—Modern science is the marvel of our age. From small beginnings in the seventeenth century, it has produced a detailed knowledge so that man is now in a position to have a clear and accurate notion of his world, its creatures, his fellow beings, and himself (Fig. 19). This state of affairs has resulted from a method of study, called the scientific method. This method is marked by definite characteristics that describe and define it.

In the first place, modern science employs the method of control-experiments. For example, if science seeks to determine the effect of some factor upon growth, two groups will be studied; one group will be subjected to the factor

[1] Dunlap, K.: Mysticism, Freudianism, and Scientific Psychology, pp. 112–130, C. V. Mosby Co., St. Louis, 1920.

and the other group will not be. Thus, the control-experiment, by keeping other factors constant, is able to isolate the effect of one factor, present only in one group.

Secondly, it keeps careful statistics of its work. The minute and detailed records of experimentation in chemical, physical, and biological laboratories are known generally. It is not always appreciated that this method of science is followed by health bureaus and departments. The study

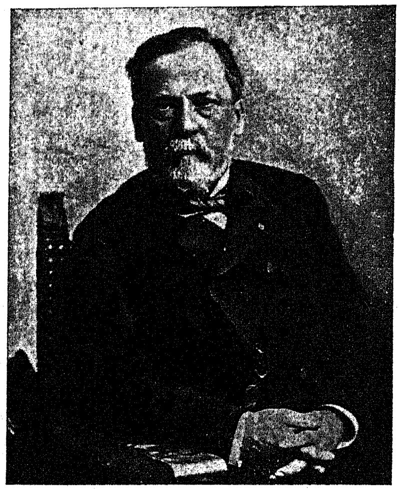


Fig. 19.—Louis Pasteur (1822–1895). Pasteur by his discoveries laid the foundation for the modern understanding of the nature of germ diseases.

of the efficacy of antitoxin for diphtheria or of vaccination against smallpox exhibits exactly this same careful recording of facts.

Thirdly, modern science keeps itself open to criticism. It invites criticism. The statistics it gathers are published widely so that its results are available to all. It presents not opinion nor belief but the actual facts as found by careful count. Moreover, both fame and promotion await the successful critic. The scientist who can show that some procedure is faulty or some records in error is not

condemned but praised. Seeking of criticism and praise of competent criticism are explicit in the scientific method. In this respect, it is markedly different from unscientific methods in which beliefs or views are urged on the ground of special authority even when such views are at variance with the facts.

Finally, it is the spirit of modern science to offer every opportunity for checking error. There is no secrecy in science. It seeks review of its findings and is eager to determine error in its procedure since truth and not opinion is its goal.

Science and Health.—The ways of science have been described. The biologist working in his laboratory studies the thin sections of a cell and makes a report concerning his findings. His work is repeated by other observers in this field and his claims are confirmed or denied. Continual effort by many workers in time builds up a statement that cells are bits of protoplasm containing a nucleus. From these simple facts other researches go on to learn how cells act, until we arrive at such remarkable achievements that an individual may be protected against typhoid fever by inoculation of dead typhoid bacilli. Moreover, the same scientific procedure is at work in all phases of human endeavor. The practical elimination of typhoid from the armies of all nations, the control of smallpox by vaccination, the eradication of yellow fever, the perfection of the automobile, the electric lamp, the aeroplane—these achievements of man have resulted from scientific procedure. The willingness to accept demonstrated fact in industry has been the fundamental cause for its phenomenal growth, but the failure to face facts in the human world of idêas, customs, and beliefs is a characteristic weakness of man. It is relatively easy to modify procedure in the factory, to face the facts of factory management as they deal with pig iron and coke, but it is more difficult to get people to adjust prejudices, to develop new habits, and to achieve a really scientific attitude.[1]

[1] Robinson, J. H.: The Mind in the Making, Harper and Brothers, New York, 1921.

The Long Struggle with Disease.—Although the ancients practiced many healthful customs, most of their knowledge and all of their skill were lost in the dark ages that followed the fall of Rome. In this generation we are now rediscovering the healthfulness of sunshine—a fact well established in the customs and architecture of both Greeks (Fig. 20) and Romans.

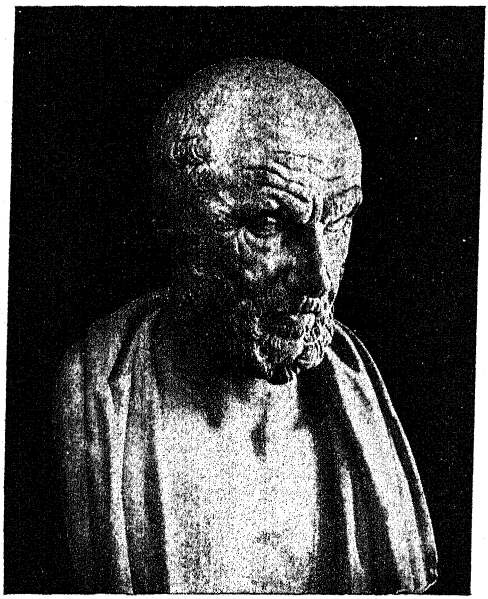


Fig. 20.—Hippocrates (460–370 B. C.). Hippocrates advocated the use of sunshine by the Greeks. Greek marble bust in the British Museum. (Garrison's "History of Medicine.")

Modern hygiene and sanitation and their application to the problems of personal and public health began in the latter part of the nineteenth century in the work of Chadwick, Simon, and von Pettenkofer. Their beginnings were broadened and given further scientific foundation through important discoveries by Pasteur, Koch, Jenner,[1] Pfeiffer,

[1] Jenner's work was done in the latter part of the eighteenth century, but its application was broadened greatly in the nineteenth and twentieth centuries.

Behring, Kitasato, Lazear, Reed, Gorgas, and recently by Schick and the Dicks.

Studies of environmental factors in health were the first contributions. The work of Chadwick and Simon resulted in the construction of water and sewage systems in the city of London. The pure water supply of American cities is the product of science applied to sanitary problems. Von Pettenkofer contributed studies in the effect of foods, clothing, and habitations upon the health of man. From

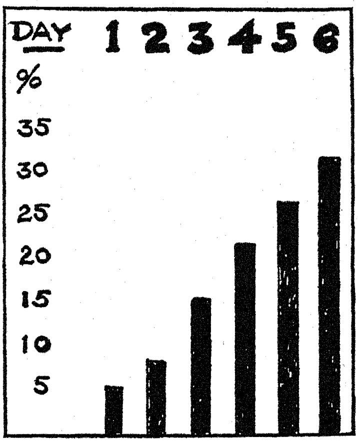


Fig. 21.—Diagram showing percentage of deaths in 20,794 cases of diphtheria, classed according to the day of the sickness upon which antitoxin was given. With each day's delay in giving antitoxin the danger increases.

these early efforts, the continued attack of scientific procedure has evolved standards for disposal of wastes, for pure food and water supply, for elimination of insects that transmit disease, for cleanliness, and for proper housing.

The second phase of science's effort to promote health and combat disease arises out of the tremendous achievements of Pasteur. Pasteur and Koch established a new factor as a cause of disease, a microscopical organism, popularly called a germ. These men laid the foundation for our understand-

ing of isolation, disinfection, and quarantine, but Pasteur will be remembered always as the man who brought the menace of hydrophobia (rabies) under the control of science. Jenner developed the technic for vaccination against smallpox and a plague that devastated whole communities in medieval times is now under control. Wright, Pfeiffer, and Kolle did the initial work in vaccination against typhoid fever and this measure employed in the armies of the world is rightly hailed as one of the greatest achievements of science. Behring isolated the diphtheria bacillus and the use of antitoxin for this disease has made great progress (Fig. 21). Recent scientific work has produced the Schick test that tells the susceptibility of persons to diphtheria, toxin-antitoxin that affords immunity to diphtheria, the Dick test for scarlet fever, scarlet fever serum, and measles convalescent serum.

Science has been active in every direction to find the cause and to devise the cure for disease. The victory over hookworm in the South, the elimination of yellow fever from the Canal Zone and gulf states (Fig. 22), the correction of deficiency diseases, especially the development of insulin for the treatment of diabetes and Minot's and Murphy's work in pernicious anemia—these are high lights in the long struggle of science with disease.

But these scientific achievements serve man only as they are put into operation for all mankind. Dr. Wm. H. Welch recently expressed this thought.

"When a Koch discovers the tubercle bacillus; a Banting discovers insulin for the relief of diabetes; a Von Behring an antitoxin for the cure of diphtheria, or a Park demonstrates the value of the toxin-antitoxin for the prevention of diphtheria, the world draws a long breath as if saying to itself, 'Now we are rid of that terror which has haunted the human race for centuries!'

"It then straightway forgets and goes on its way comfortably assuming, of course, that the great discovery or invention is being carried into effect.

"The actual facts are quite different. A few people, those of unusual initiative, or ample means, or who happen to be under the care of exceptionally alert physicians, or within the jurisdiction of exceptionally competent health officers, receive the benefits of the new discoveries, but the great mass of the human race will go on as before, and the death rate from these diseases will be reduced slowly

and over long periods of time, unless the entire process is speeded up through the unified, intensive efforts of allied health agencies—public, private and voluntary."

The Unity of Mind and Body.—From the fourth to the fourteenth century the western world was dominated by a belief that the spiritual was the only true reality. This

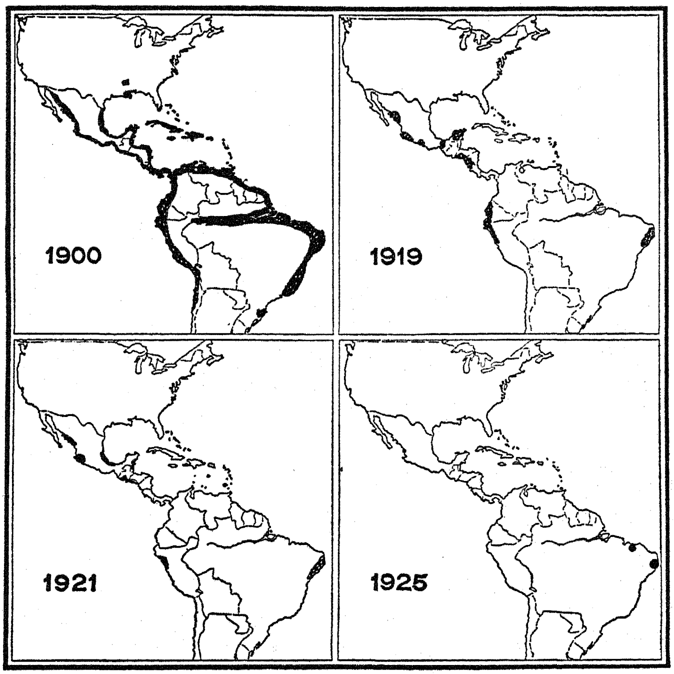


Fig. 22.—Results of a quarter century of yellow fever control. Disappearance of the black margin along the coast indicates the decrease in yellow fever.

belief took various forms. It culminated in efforts by some to achieve spiritual excellence through degradation of the body. Although such extremes are not found today, except among certain wild tribes in which bodily torture is employed as a means of appeasing the spirit world, nevertheless this notion of the reality of spirit and the unreality of

body has flowed into the customs, speech, and thought of the modern world.

The philosopher Berkeley in the first part of the eighteenth century evolved a system of philosophy designed to counteract the growing materialism of his age. This philosophy, known as Berkeleian idealism, in effect claimed that no existence of matter is conceivable or possible which is not conscious spirit. In this view, no object exists apart from mind and mind's idea of it. For example, a table exists only as one recognizes in mind its existence.

The ideas that spirit is the only true reality and that matter exists only as it is recognized have been applied to man and his affairs. These views maintain that the human body is only an idea of mortal mind. Since the days of Berkeleian metaphysics and speculation concerning matter and spirit, the researches of science have been describing many aspects of man's nature. Studies in anatomy, physiology, chemistry, biology, psychology, and pathology have revealed not a dominance of either mind or body in normal life but a mutual interdependence and relationship.

This reliance of one upon the other for proper functioning is today well established.[1] It is well known that disturbance in either body or mind affects the other (Fig. 23). Disordered emotions, such as fear, hatred, pessimism, may produce physical disturbances of the alimentary or circulatory systems. On the other hand, disorders of the heart, blood vessels, and alimentary canal are often accompanied by psychic disturbances. Body and mind are interdependent.

Evidence from various scientific fields emphasizes this unity of mind and body. It is attested by all the common

[1] Woodyat, R. T.: Psychic and emotional factors in general diagnosis and treatment. *Journal American Medical Association*, September 24, 1927, p. 1013.

Hunt, J. R.: Nature and treatment of psychic and emotional factors in disease. (Same issue, p. 1014.)

Foster, N. B.: Psychic factors in the cause of cardiac disease. (Same issue, p. 1017.)

McLester, J. S.: Psychic and emotional factors in their relation to disorders of the digestive tract. (Same issue, p. 1019.)

Neilson, C. H.: Emotional and psychic factors in disease. (Same issue, p. 1020.)

experiences of mankind in trying to live finely and efficiently. Human personality at its best neglects neither the spiritual nor the physical in life; even those greatly engaged in spiritual affairs recognize that a day of high moral purpose is begun appropriately, not by neglect of the body but by proper provision for its needs. Long before the scientific evidence was available, Browning with poetic insight sensed this unity in the words:

"Nor soul helps flesh more now than flesh helps soul."

Man, the organism, is composed of millions of cells. All that he knows, believes, or does merely reflects the activity

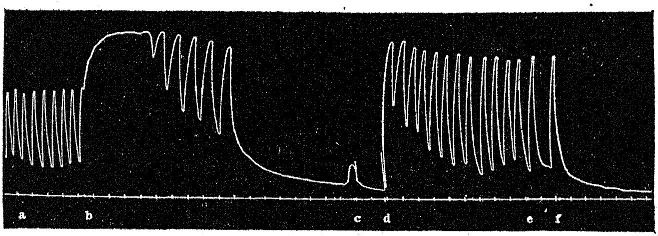


Fig. 23.—Emotional states modify muscular and glandular response. This is well shown above in which "excited" blood (at b) and "quiet" blood (at d) from the same animal, is applied to intestinal muscle initially beating in Ringer's solution. (From Cannon, "Bodily Changes in Pain, Hunger, Fear and Rage." Published by D. Appleton and Co.)

of these cells or groups of them. The cells of the brain are specialized for certain functions in precisely the same way that liver cells, or muscle cells, or kidney cells are endowed with particular abilities. The millions of diverse cells composing man are interrelated and correlated in their actions by various forces and materials, both internal and external. The notion of the brain as a directing center is quite misleading, for as Herrick says, "The brain, apart from the rest of the body, initiates nothing." To conceive of man as receiving messages of various kinds from the outside world, as correlating these with respect to past experiences, and as responding to these stimuli in a variety of ways depending upon the nature of the internal conditions as well as the ex-

ternal forces and materials is a much more accurate picture of the organism than that of a body with a directing mind. The scientific view of man dismisses the arguments about matter and mind and refuses to deal with metaphysical terms at all. Man learns in certain ways; he reacts to precise situations; he acquires particular skills, prejudices, facts, and diseases. These are the data of science.

This scientific view is especially significant for hygiene. The problem is now pointed. How can man become a more alert and sensitive receiving organism—more aware of his world? How can he correlate the myriad messages that pour upon him, with a greater orderliness, achieving integration? How can he respond more effectively to the opportunities and responsibilities of his world? These are the larger problems of hygiene.

Structural and Functional Diseases.—It is difficult for one today to appreciate the hold of the doctrines of Aristotle upon the human mind up to the eighteenth century. So established were the dicta of the great Greek that for centuries nobody examined nature in her various forms to obtain knowledge directly from the source but looked always at what Aristotle had said about it.

We marvel at the achievements of modern science and yet nothing that has come out of the scientific laboratory in the twentieth century seems half as significant for human welfare as the break with the authority of Aristotle and the tradition of the past in the sixteenth and seventeenth centuries.

From time to time through the past centuries individuals presented facts that contradicted Aristotle. The search for truth led Vesalius (1516–1564) to declare that Galen's work—Galen was to anatomy what Aristotle was to philosophy—could not be founded upon the human body because he had described an intermaxillary bone which was not present in man although found in certain lower animals. In the seventeenth century Leeuwenhoek (1632–1723), a Dutch microscopist, described in detail certain anatomical structures. Copernicus had published his book, *Concerning the Revolutions of the Heavenly Body*, and Vesalius had made

his contribution *Concerning the Fabric of the Human Body.* Then some two hundred years after Leeuwenhoek's papers in the *Philosophical Transactions* of the Royal Society Schwann and Schleiden fully established the fact that the human body is composed of cells. What an epochal discovery! The views of man and his universe, previously regarded as final and incontrovertible, were assailed successfully again and again, and the humors of Aristotle gradually faded as the mist before the sun. Careful microscopic work on actual plant and animal tissues began to supplant an arm chair description of man.

Out of this background of mistaken authority and faulty tradition, the scientific spirit gradually evolved and from the memorable work of Schwann arose the science of histology which deals with the detailed description of the structures of human cells and tissues. For about a hundred years workers in this field of science have been patiently making sections of tissues, staining them with various chemicals, and reporting to the world what they found. From this kind of objective research carried on in scientific circles of all enlightened nations, standards of cell structure have been established. Therefore, today the microphotographic and narrative descriptions of a normal heart cell, normal liver cell, normal blood cell, in fact norms for every kind of body cell are well known.

Schwann published his work, *Similarity of Structure and Growth in Plants and Animals* in 1839. Nineteen years later Virchow gave to the world his *Cellular Pathology* which laid the basis for our understanding of abnormalities in cells.

The variations from normal form or structure in the body cells are well known. For example, a section of a normal kidney will show under the microscope the cells well formed, their outlines clear, a typical granular quality in the cytoplasm, and the nuclei in characteristic patterns. This is normal. In one form of disease, a type of nephritis, the cells are changed. They appear as partly destroyed, the cell outlines are faint, frayed and irregular, and the nuclei are few and faintly stained. These contrasting conditions are clearly shown in Figs. 24 and 25.

Pathology is a description not only of diseased states but also of the reparative processes that occur. It is an established fact that damage to epithelial structures is repaired,

Fig. 24.

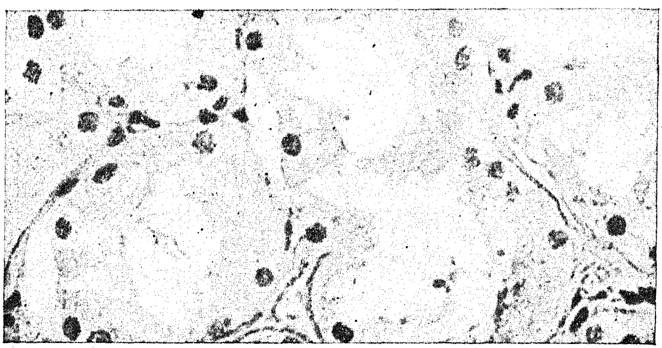


Fig. 25.

Figs. 24 and 25.—The upper illustration shows cells and tubules of a normal kidney (Maximow); the lower one shows degeneration of similar structures (Oertel). These contrasting sections well portray the nature of structural change in diseased processes. Inflammation has destroyed cells in the lower illustration and a kidney so injured is less able to do its work regardless of our ideas about "mortal mind."

not by regeneration of the kind of cell destroyed, but by the production of new connective tissue. Thus in a diseased kidney, lung, heart, liver, or intestine, the damage to the part results in loss of the kind of cells that alone can do the

work required and the replacement with cells that are entirely unable to act in any such functional capacity. This structural damage impairs the capacity of the organ to do its work in precisely the same way that damage to an electric generator reduces its power to do its work.

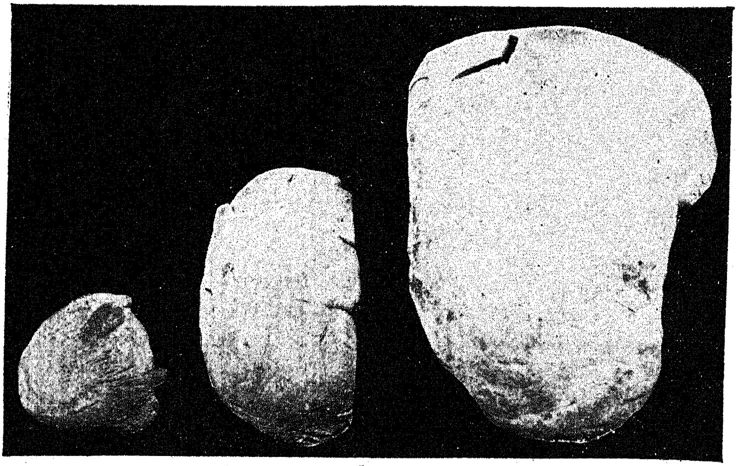
The practical application of these facts may be stated somewhat as follows: If the cells of a part are injured and the cellular structure damaged, they may return to normal after the disease is over, or if the injury is extensive they are apt to remain defective throughout the life of the individual. If the injury is sufficiently lethal in intensity or in kind, the cell is killed and is replaced by connective tissue cells. If the injury is not sufficient to cause death of the cell, the temporary damage may be recovered from completely. Moreover, the seriousness of the injury is dependent upon the kind of cells involved and their location. Thus, when the skin of the hand is cut, epithelial cells are destroyed and the scar that forms is composed of connective tissue cells. As a rule the damage is slight or even negligible. On the other hand, if the epithelial cell of the islands of Langerhans in the pancreas are destroyed, the injury becomes important, for these cells are engaged in the work of producing a chemical for the blood that enables the individual to burn sugar in the muscles. Hence, the extent of the damage and the resulting decrease in power of the cells to do work depend upon several factors, such as, exact location of the injury, severity of the injury, ability of the part to compensate, the margin of function available, and similar ones.

Structural diseases then are those in which some alteration occurs in the form and appearance of the cells and tissues of the part (Fig. 26). The underlying conditions are very real. There is no question about changes occurring. In this group are such common diseases as pneumonia, typhoid fever, tuberculosis, nephritis, leukemia, endocarditis, scarlet fever, cancer, and many others. The alteration in the size of the spleen in typhoid fever and leukemia is shown in Fig. 26.

Functional diseases, however, are quite unlike structural

ones in the underlying conditions and causes. Instead of cells and tissues showing profound alteration in form they show none whatsoever. And yet in spite of their normal size, shape, and structure they function improperly. In the former, the loss of function is due to alteration in structure; in the latter it is quite unrelated to the structure of the part.

Functional diseases are very real but only to the person who suffers from them. To the clinician there may be no



a b c

Fig. 26.—Science recognizes that disease causes disturbance of organs. Above is shown the spleen in three different conditions. From left to right. a, Normal spleen; b, spleen in typhoid fever; c, spleen in leukemia. (From the Pathological Museum of McGill University. Adami and Nicholls, "Principles of Pathology." Published by Lea & Febiger.)

signs available and only the symptoms of pain, or weakness, or disability that the patient describes. Diseases of this type are due to psychic and emotional disturbances that may be either recent or remote. Often fear of some kind is explanatory of the condition but no single cause operates in all cases. All sorts of organic diseases may be simulated. In one person there is a hysterical paralysis, in another a gastric ulcer, in another continued headache and insomnia.

Many of the functional disturbances arise out of psychopathic constitutions and all illustrate aspects of defective training in attitudes and faulty methods of adjustment to life's problems.

The test of life is the living of it. If one can find satisfaction even though it rises no higher than a full stomach and a night's sleep after fatiguing labor, one escapes functional disease. On the other hand, when life results in responsibilities that dare not be faced, in fears of various kinds, and in a longing for life that is not *now* being lived, then functional disease may develop to relieve one of dreaded responsibilities, to secure attention and sympathy from friends, and to find a place for oneself in a social group.

The explanation of what happens in the brain, along the nerves, or in other parts during the course of functional disturbance is quite lacking. Nothing is known of the cellular processes at work. There remains, however, the well-established fact that persons who have been unable to adjust to the life that now is, often seek to find a way out. The way varies. Some adjust to the pressures of life by stealing, some commit murder, and some by developing any one of a dozen different functional diseases. Recently persons who had suffered severely from the economic depression found relief for their maladjustment by changing their political beliefs. Communism may thus cure when medicine fails.

Some Scientifically Determined Facts.—The history or course of a disease is known by the records of its occurrence, its morbidity rate, its mortality, and its complications. The influence of any new method of treatment may be determined by statistical study of the death rate. The death rate is subject to the same kind of scientific testing as the birth rate, immigration, or any other process in which the facts are gathered. The use of antitoxin for diphtheria has been one of the triumphs of scientific medicine. The reality of the problem and the service of laboratory science are indicated by the following table:[1]

[1] Data for the table taken from How to Protect Children from Diphtheria. A Handbook of Information of the New York Diphtheria Prevention Commission.

HALF A CENTURY OF DIPHTHERIA IN NEW YORK CITY

	Estimated population under fifteen.	Average number of cases reported.	Average number of deaths.	Rates per 100,000 under fifteen.		Case fatality per cent.
				Cases.	Deaths.	
1874–1878	504,500	5,630	3,211	1,116	636	57.04
1879–1883	573,800	5,950	3,293	1,037	574	55.34
1884–1888	640,600	5,902	3,548	921	554	60.11
1889–1893	723,100	7,760	3,331	1,073	461	42.93
1894–1898	895,100	14,271	3,246	1,594	363	22.74
1899–1903	1,067,200	14,027	2,095	1,314	196	14.93
1904–1908	1,219,500	15,662	1,784	1,284	147	11.48
1909–1913	1,371,700	14,780	1,434	1,077	105	9.70
1914–1918	1,504,000	14,001	1,200	931	78	8.57
1919–1923	1,608,000	12,353	920	768	66	7.45
1924–1928	1,675,100	10,110	643	603	38	6.36
1928–1933	1,688,000	4,363	229	258	13.5	5.24*

* The notable decrease in this period reflects the effects of the diphtheria prevention campaign begun in 1929.

In commenting on this table Dr. William H. Guilfoy, Director, Bureau of Vital Statistics, Department of Health says,

"It can very readily be seen that the spectacular decrease in the mortality as well as the case fatality from this disease, began shortly after von Behring's discovery of diphtheria antitoxin in 1893. In this city antitoxin was first made available by the Department of Health early in 1895, but it was several years before the new remedy became generally used. I have therefore given the mortality rates in five-year periods prior to and after 1898. It will be noted that during the five years succeeding 1898 the death rate dropped from 363 deaths per 100,000 children living under fifteen years of age, to 196, a decrease of 46 per cent as compared with the immediately preceding five-year period. Going back still earlier, we see that during the period 1874 to 1878 there occurred 636 deaths out of every 100,000 children living under fifteen years of age. Contrast this with the figures for the five-year period just closed, from 1924 to 1928, when only 38 deaths occurred out of every 100,000 at this age group, a decrease of 94 per cent. We might express this still more clearly by saying that if the death rate of the first quinquennium had prevailed in the one just closed an

average of 16,654 deaths would have occurred each year during the last five years as compared with the average of 643 deaths which actually occurred. In other words the present rates represent an annual saving of 10,011 lives among children under fifteen years of age."

In 1922, a campaign was started to immunize the child population of Auburn by means of toxin-antitoxin, under the auspices of the State Department of Health. Auburn, N. Y., a city of 35,000 had 97 cases and 13 deaths that year. The following shows the results of this campaign; note the years without deaths from diphtheria in Auburn:

Diphtheria in Auburn

Year.	Cases.	Deaths.
1920	104	17
1921	131	14
1922	97	13
1923	47	4
1924	22	1
1925	20	0
1926	8	0
1927	10	0
1928	13	2
1929	2	0
1930	0	0
1931	2*	1
1932	2*	1
1933	2	0
1934	1	0
1935	3	0

* The 2 cases in 1931 occurred in women, age forty-one and fifty years; they had never been immunized. The 2 cases in 1932 occurred in a child of one year and a girl of eighteen years. Neither had been protected.

What is true for diphtheria and antitoxin is even more strikingly shown in the results from typhoid inoculation by a comparison of the cases of and deaths from typhoid in the United States Army before and after compulsory inoculation. The following, given by Major Lyster, covers the period from 1908 to 1914:

VACCINATION AGAINST TYPHOID IN THE UNITED STATES ARMY

Year.	Number of persons vaccinated.	Number receiving three doses.	Cases of typhoid.	Army mean strength.
1908*	0	0	239	74,692
1909*	830	621	282	84,077
1910*	16,093	11,932	198	81,434
1911*	27,720	25,779	70	82,802
1912†	40,057	all	27	88,478
1913†	25,086	all	4	90,752
1914†	35,902	all	7	92,877

* Voluntary inoculation. † Compulsory inoculation.

Since 1912 the cases 27, 4, 7 were, with few exceptions, in men who were not inoculated for some reason or other, or who had contracted the disease before enlistment.

Havard[1] shows the value of inoculation in compiling the admission and death rate for typhoid for the years 1903–1912. It should be noted that the large number of men voluntarily submitting to inoculation accounts for the low rate in 1910 and 1911, immediately before it became compulsory.

TYPHOID MORBIDITY AND MORTALITY RATES IN UNITED STATES ARMY, 1903–1912

Years.	Death-rate per 1000.		Admission rates per 1000.
1903	.28		5.82
1904	.27		3.62
1905	.30		3.57
1906	.28		5.66
1907	.19		3.53
1908	.23		2.94
1909	.28		3.03
1910	.16		2.32
1911	.11		.81
1912	.03		.31

[1] Havard, V.: Manual of Military Hygiene, Wm. Wood & Co., New York, 1917, pp. 36, 37.

Havard,[1] in commenting on the value of inoculation against typhoid, says:

During the four years 1909–1912 no deaths occurred among vaccinated soldiers in the United States.

Woodhull,[2] in commenting on typhoid in the Civil and Spanish-American wars, says:

According to statistics used by Major F. F. Russell (Military Surgeon, June, 1909) the Federal army alone had more than 80,000 cases of typhoid fever in the war for the Union. During five months in the Spanish War (Official Board on Typhoid Fever) we had 20,738 cases and 1580 deaths among 107,973 officers and men in camps within the United States, or 19.26 per cent sufferers from the disease.

The American Army in the World War had compulsory inoculation. Making allowances for failures in technic or in organization, it is to be noted that from September 1, 1917 to May 2, 1919 there were 213 deaths from typhoid in an army with a mean strength for that period of 2,121,958.

Additional evidence is available in comparison of the camp at Jacksonville in 1898 (Spanish-American War) and the camp at San Antonio in 1912 (mobilization on the Texas Border).

INOCULATION RESULTS IN THE AMERICAN ARMY

	Number of Soldiers at each camp.	Number of cases of typhoid.	Number of deaths from typhoid.
Jacksonville (Fla.) 1898, before compulsory inoculation	10,759	2,000	248
San Antonio (Tex.) 1912, compulsory inoculation....	12,801	2	0

It is an interesting and instructive fact that in the Spanish-American War 243 soldiers died of wounds and 1580 perished of typhoid fever (Fig. 27).

In the light of such evidence it is, indeed, surprising how apparently well-informed persons will oppose and carry

[1] Havard, V.: *Loc. cit.*
[2] Woodhull, A. A.: Military Hygiene for Officers of the Line, John Wiley & Sons, New York, 1909, p. 308.

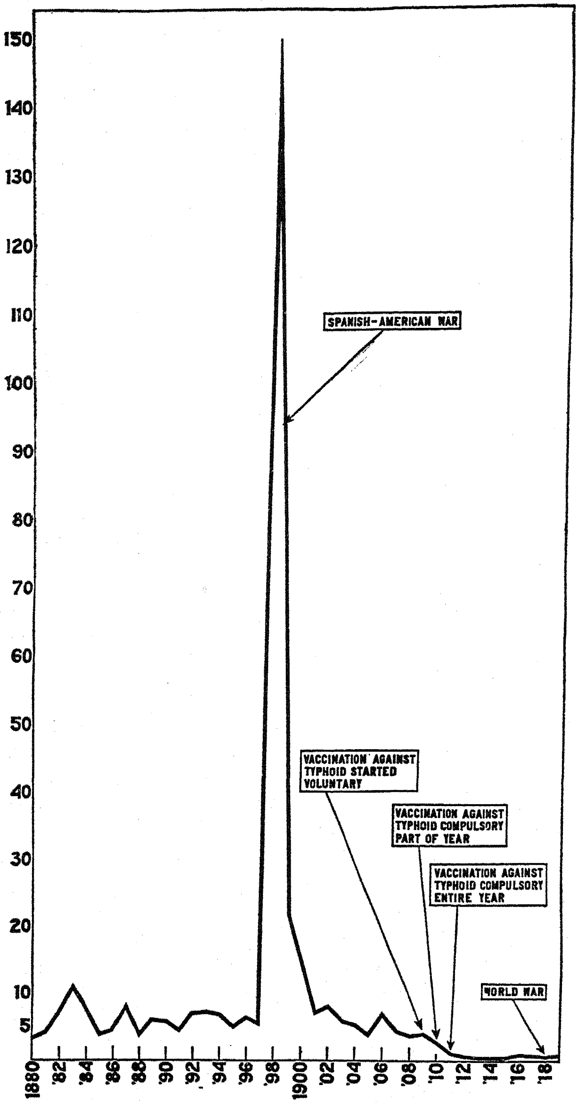


Fig. 27.—Typhoid fever. Annual admission rates per 1000 of white enlisted men of the United States Army for the years 1880 to 1919 inclusive. (By courtesy of the War Department, Office of the Surgeon General.)

on obstructive propaganda in order to retard scientific disease prevention. Comparison of smallpox and typhoid in the three wars should be illuminating on this point.

The following figures given by the Office of the Surgeon General, War Department,[1] show a vivid comparison for typhoid in three wars:

DEATHS FROM DISEASE IN THREE AMERICAN WARS

Disease.	Number of deaths that occurred in World War, September 1, 1917 to May 2, 1919. Average strength approximately 2,121,958.	Number of deaths that would have occurred during the period September 1, 1917 to May 2, 1919 if the Civil War death-rate had prevailed (July 1, 1861 to June 30, 1865).	Number of deaths that would have occurred during the period September 1, 1917 to May 2, 1919 if the Spanish-American War rate had prevailed (May 1 to September 30, 1898).
Typhoid fever	213	48,978	65,292
Smallpox	5	9,135	36

The thoughtful person will not ignore such facts when dealing with matters so vital to health and happiness.

Facing the Facts.—All the work in the public health field today emphasizes the danger to others that comes from contact with mild cases.[2] We have only recently appreciated the significance of "walking typhoid" as presenting a condition in which the individual had the disease in such mild form that he was not aware of the infection, and yet was capable of transferring the disease to others. Many of the communicable diseases have mild forms, and so when they fall into the hands of irregular systems of healing marvelous cures are reported. Not infrequently individuals recover from infections without medical attention. The scientific physician knows that in many diseases Nature performs the cure; his task as a physician is to assist Nature at a critical point in the struggle; to sustain a failing heart, to relieve a congested lung, to eliminate accumulating poisons.

[1] From a letter by Colonel W. P. Chamberlain, M. C., December 2, 1921, File S. G. O. 710 (Typhoid).

[2] Chapin, H. D.: Health First, The Century Company, New York, 1917, pp. 214, 215, 217.

Now in the mild cases of disease in which Nature needs no assistance any procedure used as a treatment may be heralded as a cure. But it is also the characteristic of mild disease that it may be transmitted. This complicates the problem woefully. The child with scarlet fever in mild form may infect an entire class in school.

The principle of magic is invoked whenever one expects to get results without being true to the conditions by which the results can be secured. The facts about the causes of disease are real; also real are the conditions under which diseases develop. There are facts that indicate the responsibility of individuals to use science and its teachings.

The available facts regarding the causes and nature of diseases are many but they are not complete. Great gaps exist in spite of the tremendous achievements of the past twenty-five years.

Moreover, in a service that requires the combined efforts of many persons, there is always the possibility of individual failure to carry out the assignment. The human factor is present in medical services, but an example of failure should never be used to judge more than the standard can measure. It is well known that the efficacy of the modern treatment for diphtheria is demonstrated as clearly as is the efficiency of the Westinghouse air-brake for stopping trains. At times antitoxin fails; at times the air-brake does not prevent wrecks, but this is not an argument for going without air-brakes, nor for withholding from any child with diphtheria the chance of life by failing to employ demonstrated methods and procedures.

The Rôle of Psychotherapy in Functional Disease.—Many persons are so badly trained mentally and so poorly controlled emotionally that even the slightest bodily disturbance is made to appear serious. Indeed, any emotional upset may produce symptoms of disease, especially in the circulatory, digestive, and nervous systems. It is in this kind of disease that psychotherapy is effective (Fig. 28). There are dozens of beliefs ranging all the way from Hindu Yogi to Applied Psychology that are effective in such cases. Whenever the emotional life is disturbed, a belief or proce-

dure that instils confidence and restores courage will be helpful in controlling the production and expenditure of energy. It may be this fact that explains numberless systems of healing—the procedure may be only a phrase

Fig. 28.—A South Sea Island "medicine man" in the full robes of his office. Psychotherapy of the medicine man is good "medicine" for those with *functional* disease who *believe in* the form of treatment. (International.)

repeated: "Every day in every way I grow better and better."

In the course of routine and daily work physicians and surgeons of the medical profession are performing wonderful cures, operations, and diagnoses and without the publicity that attends the efforts of religious healers to cure

cancer and all disease, in fact, by laying on of hands and most fervid prayers.

"An interesting though not unique case is described in a recent bulletin sent out by the Federal Board for Vocational Education. Among the blinded ex-service men was a Negro who seemed to be blind in both eyes. Neither eye could perceive five fingers at any distance. He had faint light perception and there was hope of sight restoration in one eye. The man was about to be assigned to a workshop for the blind when a physician managed to persuade him that he was not blind. The report of the case reads: He was suffering from psychoneurosis hysteria giving rise to marked blepharospasm[1] and photophobia[2] and amaurosis.[3] All physical findings negative. Treatments by suggestion completely cleared up all symptoms and I discharged this man cured."[4]

To help to prevent the need for psychotherapy, education is interested in training people in self-direction and self-control. It seeks to help them to personally take charge of their lives, to face facts honestly, and to withstand trials with self-reliance. To face the problems of life, the infections, the broken promises, the distorted dreams, the stings of poverty and to see the truth in every situation, so far as possible, with a single-mindedness of purpose to follow where the truth leads—this may not be possible for all, but certainly may well be the goal of those interested in living at their best.

The Call of the Occult.—It is difficult to educate people to seek such goals. Men in all stages of development have been believers in spirits, and from time to time have brought forward evidence to support their belief. The witch riding a broom and the modern "Patience Worth" all spring from the same source and are equally irrational. Tap the stream of life where you will, the same kind of belief in the mystical that leads men to expect cancer cures from healing mental

[1] Blepharospasm—spasm of the circular muscles of the eyelids.—J. F. W.

[2] Photophobia—fear of light.—J. F. W.

[3] Amaurosis—blindness of the retinal or optic nerve type.—J. F. W.

[4] Jour. Amer. Med. Assoc., March 27, 1920, p. 890.

rays will spring forth. Probably no phase of this belief in spirit agency is more persistent than the medical. Health for such persons is the *summum bonum*, and they will reject scientific evidence and procedure acceptable in other fields and in other problems, to partake of mysterious patent medicines and other palpable frauds.

The history of medicine is one significant view of the history of civilization. One could write a history of the human mind in terms of its curious ideas of disease. To a very large extent, the influence of the "medicine man" of tribal days is still upon us. Uncivilized people today still

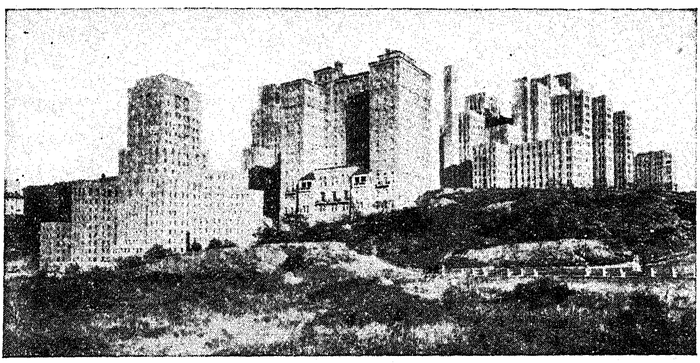


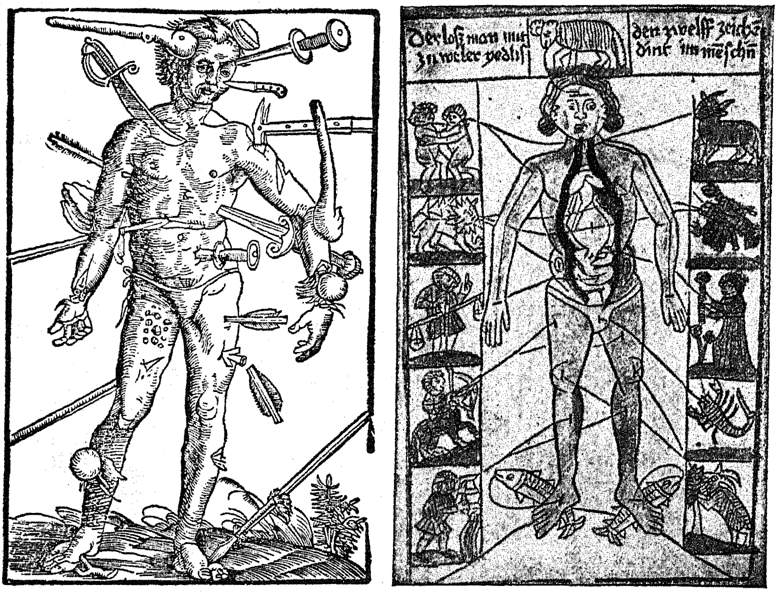
Fig. 29.—The Medical Center of Columbia University. (Underwood & Underwood.)

rely upon tokens, charms, and various devices of the chiefs to frighten away the evil spirits of disease. The *anting-anting* of certain groups of Filipinos, the *soul-catcher* of the natives of Borneo, the use by peasant Chinese of spiders, cow-dung, and birds' feathers illustrate this belief in the magical and mysterious character of disease.

Americans in this century still retain many tribal attitudes toward disease and its treatment in spite of the recent progress in scientific medicine (Fig. 29). Any system of therapy that is not understood, or that seems to be in league with spirit forces at once attracts the attention. This comment is often heard: "There must be something in it."

There is of course; but usually it is not what the patient expected.

Believers in the occult and mysterious are often sincere, but their sincerity is no cloak that will hide the classifica-



A B

Fig. 30.—Specimens of the *Lasstafelkunst* (Horoscopic Medicine or Judicial Astrology. By kind permission of Professor Karl Sudhoff, University of Leipzig). A: Bloodletting man (*Aderlassmann*), from the Calendar of Regiomontanus (1475), showing the points of election for bloodletting under the signs of the zodiac. B: Wound-man (*Wundenmann*), from Gersdorff's *Feldtbuch* (1517), showing the sites for ligation of the different arteries or for bloodletting. B is a later evolutionary form of the old zodiacal diagrams, which combined an exposition of planetary influences with schemata of the viscera (A).

tion into which they must come. They represent clinical types that are well marked and fairly differentiated. The scientific man from his point of vantage "sees the ensemble of a forest in what to the wanderers in the jungle of human nature is only a tangle of trees." That individuals of sci-

entific training, work, and accomplishments at times get lost is no reflection on their background—the immediacy of a great sorrow, which one is unprepared to meet, may produce a mirage of the mysterious and occult.

For the uninformed person formulae with mystical signs and procedures will always be helpful in banishing fear and in controlling subconscious forces (Fig. 30). But any intelligent plan for life looks to a scheme of things in which Socrates' advice, "Know thyself," is a guide to go by. The dispute with the mystical, mysterious, and occult is precisely this: it dethrones reason and intelligence and seeks a solution by offering a soothing enigma. The intelligent man or woman planning for life cannot be satisfied to trust his or her "all" to anything that smacks of charms or laying on of hands.[1] The occult calls to the weak; for the strong, science will ever be the guide. Its truths, no matter how painful, how difficult to bear, requiring adjustments, no matter how long deferred, will have meaning for these.

The Conflict of Science and Magic.—The call of the occult has always made a strong appeal to man. Before the development of science there was little guidance for many of the problems of living that men faced every day, except that provided by prophecies, soothsayings, tribal customs, and magic in general. For thousands of years mankind suffered from famine, pestilence, and the violent forces of nature. These have been the great calamities of the race and man, in his primitive ways of dealing with these things, relied upon magic. To appease the gods, to devise elaborate ceremonials for amusing or frightening evil spirits were the chief reliance (Fig. 31). This great body of belief in the efficacy of magic has come down through the centuries and is seen in the speech, beliefs, and practices of modern man. Some of the more common superstitions, related to the health interest or motive, are: carrying a rabbit's foot, sitting thirteen at a table, knocking on wood, breaking a mirror, looking at a new moon over the right shoulder, Friday, the 13th, a four-leaf clover, picking up a

[1] Rivers, W. H. R.: Medicine, Magic, and Religion, Harcourt, Brace & Co., New York, 1924.

pin, walking under a ladder, a horseshoe, and standing under an open umbrella in the house. In the field of health, science is confronted with the problem of combating such beliefs and substituting rational for irrational procedures.

It is the essence of science to expect results by being absolutely true to conditions. It is the essence of magic to

Fig. 31.—The medicine man shakes his rattle to drive away "evil spirits" from the sick man who, it is believed, is possessed of them. (From Bolduan, "Public Health and Hygiene.")

expect results by evasion of the conditions. Illustrations will make clear the differences. Take rainfall for example. Science seeks to learn what conditions cause precipitation of water. It studies atmospheric vapor, temperature changes, dust particles in air, and air movements. In this fashion it

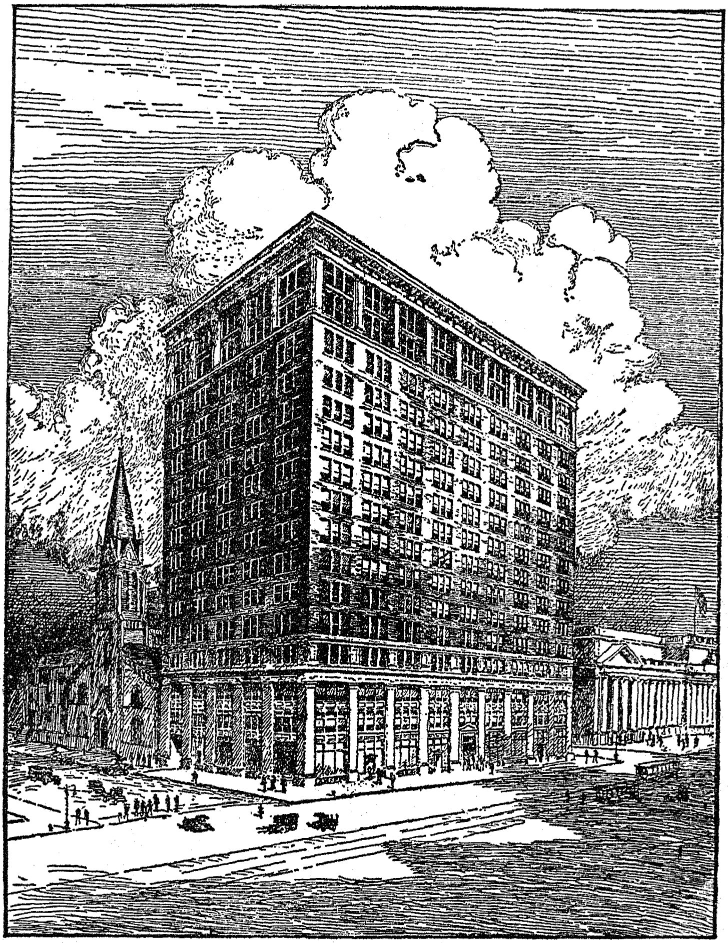


Fig. 32.—This sixteen-floor modern office building has no "13th floor." Superstitious tenants refuse to live on the 13th floor. So the 13th floor is numbered 14. (From Williams and Oberteuffer, "Industrial Hygiene." Published by McGraw-Hill Book Co.)

has learned what conditions cause rain. Hence, science expects rain when the essential conditions are fulfilled.

Magic on the other hand seeks to evade conditions by waving willow sticks, or by special ceremonials, or by days of prayer. It also seeks to avoid "bad luck" (Fig. 32). In such views, the conditions are to be overcome by special forces that do not need to be true to the facts.

Professor Dewey gives a helpful definition of magic. He writes, "The principle of magic is found whenever it is hoped to get results without intelligent control over means."[1] Applying this principle to certain problems in health, it will be observed that it is magical to expect strength of muscles by wishing for it, or to look for cure of tuberculosis, cancer, kidney disease, brain tumor, heart disease and similar organic disturbances by psychic influences or anything less than absolute fidelity to the conditions in each case.

It would appear that the distinction between science and magic is of very great significance in any intelligent effort to live most and serve best. Many persons live in a casual way without at any time realizing the opportunities of personal culture and achievement. A great weight of tradition in superstition and magic hinders any thoughtful effort to live finely and well. In determining to follow scientific guides one will feel the necessity to decide, first for taking complete charge of one's life in the face of much that is traditional, customary, and superstitious, and second for facing with absolute sincerity the facts of everyday experience.

To take charge of one's life is to deny magic. Such an attitude looks for results by intelligently controlling the means of achievement. Self-control, self-discipline, self-culture are possible as one sees oneself in a growing mastery of self on the one hand and of the environment on the other. This scientific attitude is not a denial of spiritual qualities in personality or a rejection of the social implications of an acceptable philosophy, but it does emphatically disown magic in every aspect of human living.

[1] Dewey, John: Human Nature and Conduct, Henry Holt & Co., New York, 1925, p. 26.

To face facts implies a desire to face those that are unpleasant quite as frankly as those that are pleasing. Anyone can face facts that point in the direction one is going. It takes courage and fidelity to ideals to face those that point against present inclinations, past habits, and previous commitments.

Scientific and Humanistic Principles Confused.—The faith that men have in programs, procedures, and results in some fields may be rational, but in other fields with similar control, it becomes topsy-turvy and rejects the bases that should compel action. There are recognizable these variations from rational belief in the actions of a considerable number of antivivisectionists, antivaccinationists, and others who oppose any program by society in which they must cooperate. A keen analysis of such attitudes would diagnose the condition as one of a psychosis.

These individuals are as careless of truth and scientific accuracy as they are of the falsity of their position. Throughout the war the "anti" press printed dispatches charging that our army surgeons, in order that the manufacturers of serums might grow rich, were murdering our soldiers by wholesale under pretense of giving them protection from typhoid.

In April, 1918, a circular issued by the National Antivivisectionist Federation asserted that inoculation of American soldiers was causing thousands of deaths in the army cantonments. The circular, as reported by the New York Times,[1] contained the following statement:

"Thousands of deaths deliberately inflicted upon our soldiers and sailors have passed the scandal line. It has become a tragedy."[1]

A reporter from the New York Times interviewed the vice-president of the National Antivivisectionist Federation, and the following is reported in the New York Times:[1]

She said last night that Mrs. ———, who signed the circular declaring that "thousands of deaths deliberately inflicted upon our soldiers and sailors have passed the scandal line," lived at Wayland, Massa-

[1] The New York Times, April 9, 1918. The Federation reports this circular out of print (March, 1922).

chusetts, and that the circular was sent out with the approval of the officers of the society, although they took no official action upon it.

Mrs. ——— was most reluctant to answer when asked repeatedly whether she or the organization had any evidence whatsoever that "thousands," hundreds, or tens had died as the result of inoculation. She finally said that she had received letters telling of men in the service who had been made "very ill" through inoculation, but admitted that she had no evidence of any sort that any considerable number of them had died. Pressed to tell if she had evidence that even one had died, Mrs. ——— said that the letters were confidential and that she could not disclose their contents.

She deplored the use of the word "deliberately" in the circular, saying: "Of course the society doesn't believe they kill them on pur-

Fig. 33.—Above is shown a normal white rat and one that has been fed on a diet deficient in certain vitamins. Vivisection and experimentation upon animals are the first steps in the prevention and cure of disease. The facts learned about feeding rats are used in feeding children properly. (From Williams' "Health and Ideals," B. F. Sanborn & Co.)

pose. It is an abstract belief with me," Mrs. ——— added, "that the practice is dangerous and unjustifiable."

Asked about the alarm the society's statement might cause among families of soldiers, she said:

"I hope it does create great alarm, because I think there should be a great cry against forcing people to submit their bodies to such treatment."

The achievements of scientific medicine have ever been humane (Fig. 33). The decrease in the death rate from typhoid, diphtheria, and smallpox has meant the saving of human life. Science seeks knowledge of the truth for the service of mankind.

The antivivisection efforts during the war were particularly typical of the mixed values that guide these deluded humanitarians. Their suit to prevent the Red Cross from using funds for animal experimentation was characteristic of their appreciation of relative values. Jastrow[1] in speaking of this incident, says:

> To state that vivisection has brought no benefit to mankind, in face of the overpowering evidence to the contrary, shows the utter blindness to evidence of a convinced sentimental prejudice; to urge that prejudice at this time and thus to cripple the humanitarian efforts that redeem the awful calamities of war shows the complete disregard of humane considerations to which unreason may lead. In the face of this instance of bigoted opinion, the strictures above applied to it seem criminally lenient. Like the delusions of the insane —to which such fanaticism is allied—the distinction between innocent and dangerous beliefs is most treacherous. Society cannot afford an attitude of tolerance; the menace of extreme conviction is too serious.

The antivivisectionists after the war continued the attack on the Red Cross through a call addressed to various cults "to enroll as active participants in an Association of Free People against Medical Tyranny." In the face of such use of freedom the following principle should apply:

Citizens of a liberal government, that permits such an organization to speak its absurdities without restraint, can only be satisfied with the outcome when education in science and in health has discussed the problems involved, openly and freely.

Facts and Superstition.—Scientific medicine collects, distributes for observation, study, and criticism the facts upon which it bases its procedure. The laboratory is open for inspection; the methods of obscuration are not used.

The value of antitoxin in diphtheria and the efficacy of typhoid inoculation have been stated. The determination of truth does not, unfortunately, lead automatically to the rejection of superstition by all people.

The history of smallpox ought to have meaning and does show significance to the intelligent mind. Before vaccination for smallpox was discovered the epidemics of smallpox that swept Europe were more devastating to life than the influenza epidemic of 1918 and 1919 in the United States.

[1] Jastrow, J.: The Psychology of Conviction, Houghton Mifflin Co., Boston, 1918.

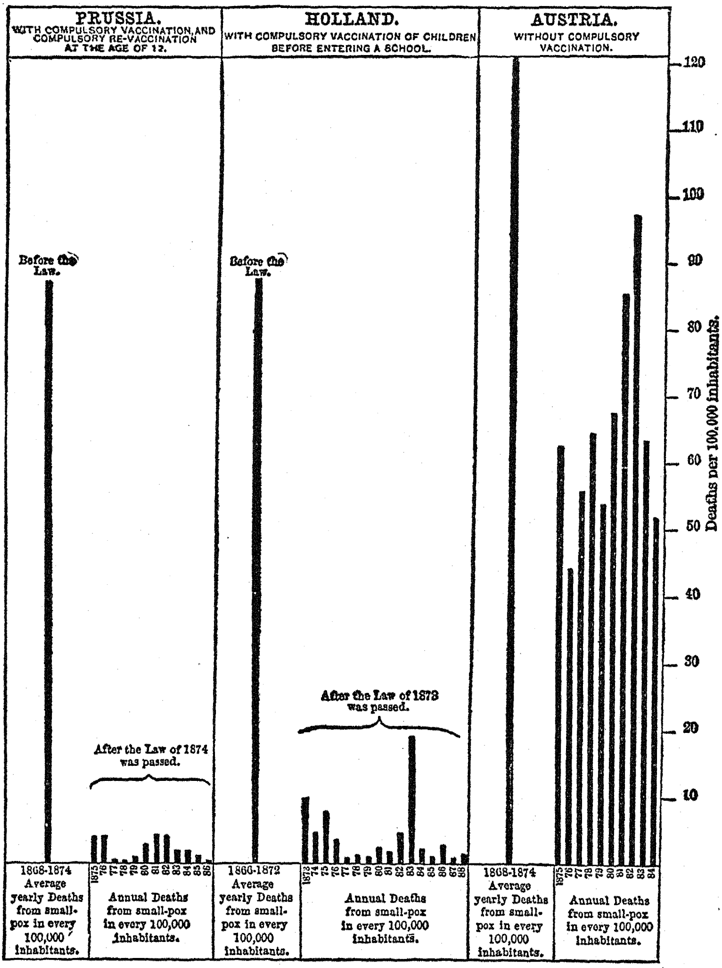


Fig. 34.—Table showing value of vaccination (Carsten).

In a recent report of the Swiss Federal Service of Public Hygiene data are given on 398 cases of smallpox. Of this number, 90.18 per cent of cases occurred in the nonvaccinated; 4.03 per cent in the revaccinated; and 5.78 per cent

in those reported as successfully vaccinated. No death occurred in the vaccinated group. It is important to note in this connection the value of vaccination as shown by two countries having compulsory vaccination and an analogous country not having it (Fig. 34).

In contradistinction to the available records of scientific medicine are the wild newspaper propaganda of that noisy group calling themselves antivivisectionists, antivaccinationists, and naturopath "physicians." In spite of fact, in defiance of truth, there exist emotional and irrational exponents of fanciful theories of disease and health. Superstition, custom, belief—these are the fetishes they worship. On questions of health they belong mentally with the group of natives in South India, described by Dr. Manley,[1] as they were attempting to drive the "Demon Smallpox" from the village of Ongole:

> The tom-toms beat all night and this morning the streets are fairly covered with chicken feathers. For blac[illegible]mallpox has taken the city and must be driven out. The priests [illegible] told the people to kill chickens and strew their feathers in the [illegible]ets so they will catch the eye of Polerimah, the plague demon, and distract her attention. The tom-toms throbbing in the air will either frighten her or please her so much that she will forget to jump down the throats of any careless mortals whom she might find with mouths opened in speaking, or with lips parted, or sleeping with uncovered faces. Yes! the goddess Polerimah is angry with the people.
>
> In the very heart of the bazaar, our native servants told us, we should find Polerimah in all her glory . . . But instead I saw only a squat little figure, no more than a foot tall, made of black mud and covered with tinsel. She was soaked with lemon-colored water which dripped off her shoulders into a widely spreading puddle round her feet.
>
> "Why so much wetness?" I asked with an amused smile.
>
> "They must keep her cool," answered our guide with great dignity. "If she gets warm she gets mad. So they have built this temple of reeds to protect her from the sun, and every few minutes the priests pour saffron tinted water over her. Whatever happens she must be kept cool."
>
> *
>
> "Now what will they do?" we asked.
>
> "They are arranging to escort the goddess out of town," said our guide. "They have done everything they could to appease her anger and make her happy; and now they are going to carry her out of town while she is in a happy frame of mind, and throw her in the ocean."

[1] From a letter by Dr. Manley to the Journal of the American Medical Association.

The procession was formed. First came the priest carrying on his head a basket in which were the bull's entrails, crowned by his head, holding in his hideous grinning mouth the bone of his front foreleg. Behind him came the goddess, carried on the head of another priest. And as the throng proceeded down the street, people by the wayside wrung the necks of chickens and threw the headless bloody bodies over the people's heads toward the image. The horns blew, the tom-toms throbbed, and the people yelled themselves hoarse, waving their reeds in the air. What is the priest screaming?

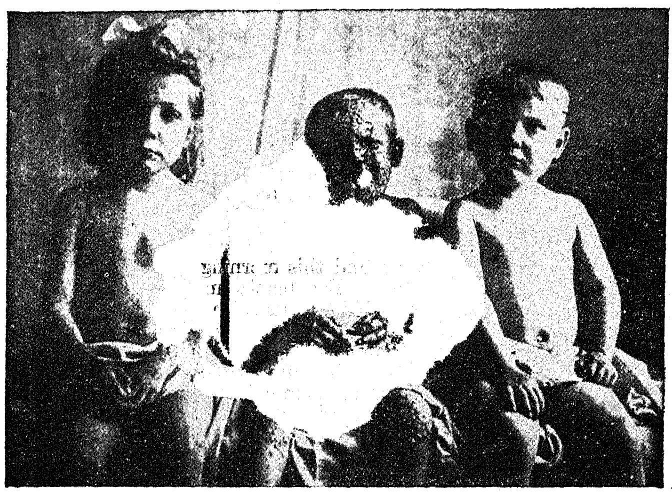


Fig. 35.—Children of one family who were brought to the Municipal Hospital of Philadelphia with the mother and father, who had smallpox. The child in the center had been considered too young to be vaccinated. The other children had been vaccinated a year before; they remained free from the disease, although for several weeks they lived in the wards of patients with smallpox. (From Welch and Schamberg, "Contagious Diseases," Lea & Febiger, Publishers.)

"Yell, brother, yell! Let confusion reign! Let not the terrible Polerimah suspect our fell designs, and fall upon us before we are safely rid of her!"

Following in the wake of the procession I came up to a young mother who was hurrying along dragging a tiny child by the hand. The little girl was staggering, her bare body was a mass of scars, her eyes heavy and dull with the intoxication of the dread disease. The child's mother cried out to Polerimah to have mercy. As her wails mingled with the shrieks of thousands the procession passed down the crooked, dusty road and out of sight.

Tonight, out there in the dark somewhere, many young mothers

are sitting in black despair, because in spite of all their sacrifices to the demon, the lives of their babies stricken with the fearful plague are surely ebbing away.

The above is a picture of superstition at its worst. The following[1] is an illustration of science serving mankind: According to R. T. Legge, M. D., there has been no case of smallpox among the students of the University of California at Berkeley since 1907 when the regents adopted the rule that all entrants must possess satisfactory evidence of immunity to smallpox before they could be admitted. This is the record of perfection in a state in which more than 9000 cases of smallpox were reported in 1924, making a case rate of 2.41 per thousand of population. Calculated on the student population of the university, 24 cases were to have been expected, if vaccination had not been enforced. There were, in fact, cases among unvaccinated employees, while all students were absolutely protected during a local epidemic in 1913.

Patent Medicines and Fear.—Of the many ignoble characteristics of the "patent medicine" business none is more despicable than its appeal to fear. The business thrives on fear and seeks by its advertising to create fear. An epidemic of disease is the occasion for new nostrums to appear claiming to prevent or cure the disease in question, and for old ones to set up new claims in harmony with the needs of the moment. The exploitation of the New Orleans public at the time of the yellow fever epidemic, the pamphleteering of the New York public at the time of the meningitis epidemic, the blatant advertising in 1918 and 1919 during the influenza epidemic, and the unwarranted claims made for sprays and gargles during the epidemic of infantile paralysis bear witness to this appeal to fear. But epidemics are not necessary for their fear campaigns. The onset of winter is a sign for increased activity for the exploiters of pills, emulsions, syrups, and decoctions. If the winter is severe they will protect against exposure and cold; if the winter is mild they will protect against changing temperatures!

[1] Vaccination facts. *Journal American Medical Association*, November 14, 1925.

There have been many exposures[1] of the frauds perpetrated by the "patent medicine" business. Samuel Hopkins Adams in the New York Tribune has conducted exposés showing the sordidness and inherent worthlessness of many of the most widely advertised quacks. Accurate and scientific information may be had on practically every nostrum on the market in two splendid volumes of Nostrums and Quackery, published by the American Medical Association, 535 N. Dearborn Street, Chicago, Illinois.

FEDERAL FOOD & DRUGS ACT

HERE ARE ITS POWERS AND LIMITATIONS REGARDING THE SALE OF "PATENT MEDICINES"

IT APPLIES ONLY TO PRODUCTS THAT ARE MADE IN ONE STATE AND SOLD IN ANOTHER (INTERSTATE COMMERCE).

IT PROHIBITS "FALSE OR MISLEADING" STATEMENTS (IN OR ON THE TRADE PACKAGE ONLY) REGARDING COMPOSITION AND SOURCE OF ORIGIN.

IT PROHIBITS "FALSE AND FRAUDULENT" STATEMENTS (IN OR ON THE TRADE PACKAGE ONLY) REGARDING CURATIVE EFFECTS.

IT REQUIRES THE MANUFACTURERS TO DECLARE (IN OR ON THE TRADE PACKAGE ONLY) THE PRESENCE AND AMOUNT, IN THEIR NOSTRUMS, OF ALCOHOL, MORPHIN, OPIUM, COCAIN, HEROIN, EUCAIN, CHLOROFORM, CANNABIS INDICA, CHLORAL HYDRATE AND ACETANILID AND THEIR DERIVATIVES.

IT DOES NOT APPLY TO PRODUCTS THAT ARE SOLD IN THE SAME STATE AS THAT IN WHICH THEY ARE MADE (INTRA-STATE COMMERCE).

IT DOES NOT PROHIBIT FALSE OR MISLEADING STATEMENTS IN NEWSPAPER ADVERTISEMENTS, CIRCULARS, WINDOW DISPLAYS, ETC.

IT DOES NOT PROHIBIT ANY KIND OF A LIE REGARDING CURATIVE EFFECTS IF THAT LIE IS TOLD ELSEWHERE THAN IN OR ON THE TRADE PACKAGE!

IT DOES NOT REQUIRE "PATENT MEDICINE" MAKERS TO DECLARE EVEN THE PRESENCE OF SUCH DEADLY POISONS AS PRUSSIC ACID, CARBOLIC ACID, ARSENIC, STRYCHNIN—NOR ANY OF SCORES OF OTHER DANGEROUS DRUGS!

(An Educational Exhibit by the American Medical Association)
24

Fig. 36.—The limitations of the Federal Food and Drugs Act are more significant than the powers. (By courtesy of the American Medical Association.)

The Challenge of Scientific Medicine.—Scientific medicine is based upon the study of the normal structure and function of the human body and the variations of that normal, called disease. In disease the cause, course, complications and outcome of diseased processes together with the results of treatment must be determined. There is no acceptance in

[1] The question is sometimes asked by students, "Why are 'patent medicines' permitted to make such extravagant claims?" The weakness of the Pure Food and Drugs Act is shown in Fig. 36.

modern medical practice of speculation for accurate observation; that as a procedure was discarded over a century ago. Careful observation of phenomena, exact interpretation and measurement of signs, complete history of the course of disease, are the fundamentals of medical practice. Every year diseases are yielding to the painstaking efforts of practitioners, research workers, and experts. Many problems have been solved; many remain to be solved. There are still diseases that cannot with absolute correctness be diagnosed. Scientific medicine is frank, free from taint of hypocrisy, fraud, and charlatanism.

The great advance in medical science, outside the field of surgery, has been the use of the biological sciences upon which must always rest the tests in diagnosis and the rationale of therapy.

Examples of the Methods of Scientific Medicine.—There are many scientific procedures available for the diagnosis of disease. These are accessible to most physicians as provided by hospitals, clinics, or their own laboratories. Not all of the ones listed below are employed in any one case but a rather complete list of examinations is given to indicate the methods available to scientific medicine in determining the state and condition of body fluids, cavities, excreta, and structures.

I. Examination of the condition of the stomach:
   1. Ewald test meal.
   2. Tests for the digestive ferments; complete gastric analysis.
   3. Fractional determination of gastric contents (Rehfuss).
   4. String test (Einhorn).
   5. Examination of duodenal contents.
   6. Motility of gastro-intestinal tract.
   7. Roentgenological examination of the entire digestive tract, both fluoroscopical and radiographic (Fig. 37).
   8. Complete stool examination, including microscopical and chemical tests for blood, toxic substances, and ovan parasites.
   9. Photograph of the inside of stomach.

II. Examination of the condition of lungs and bronchi:
   1. Fluoroscopical and radiographic examinations of lungs and chest contents.
   2. Bacteriological and microscopical examination of the sputum.
   3. Tuberculosis complement-fixation test (Fig. 38).

4. Skin tests (Mantoux).
5. Sensitization tests for asthma and hay fever.
6. Direct examination of respiratory passages, including bronchi (bronchoscopy).

III. Examination of the condition of the heart and blood:
1. Fluoroscopical and radiographic examination of the heart, aorta, and mediastinal structures.
2. Determination of blood pressure, systolic and diastolic.

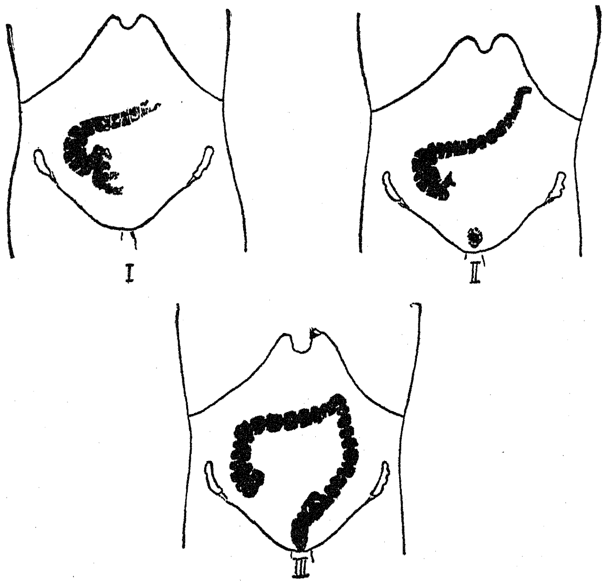


Fig. 37.—Shadows of the human large intestine obtained by means of the roentgen rays. I, Entrance of the contents of the ileum into the cecum and colon. II, The material has progressed through the transverse colon as far as the splenic flexure, some has escaped into rectum. III, The large intestine outlined by means of a solution of subnitrate of bismuth injected through the rectum. (Burton-Opitz.)

3. Electrocardiographic examination.
4. Microscopical blood tests (Fig. 39), giving complete cell count, including red cell, white cell, platelet, and differential count.
5. Hemoglobin determination.
6. Wassermann, Kahn, and Klein tests.
7. Tests of coagulation time of the blood.
8. Matching of blood tests for transfusion.
9. Blood cultures.

10. Examination for blood sugar, uric acid, urea, cholesterin, creatinine, chlorides.
11. Icteric index test for bile in the blood, and van den Bergh's test for differential diagnosis of liver disease.

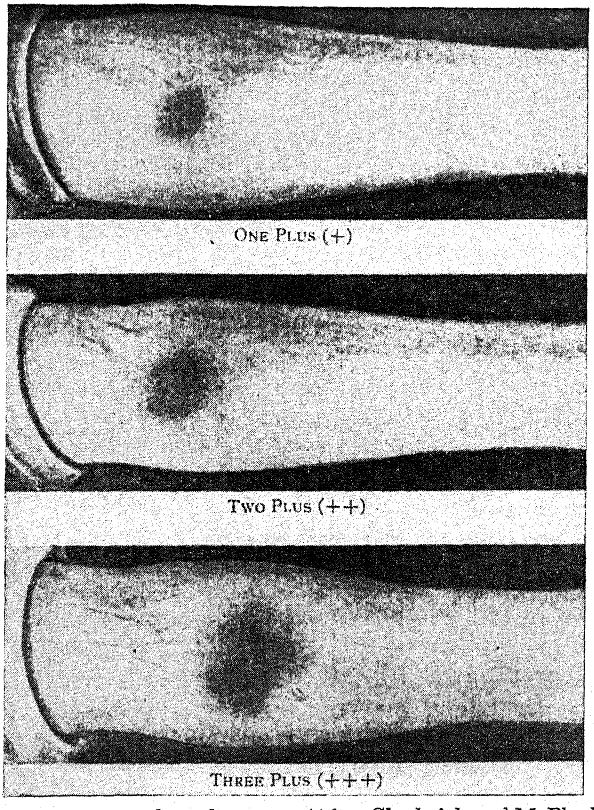


Fig. 38.—Mantoux tuberculin test. (After Chadwick and McPhedran.)

IV. Examination of the condition of the ear, nose, throat, and sinuses:
1. Transillumination of sinuses (Fig. 40).
2. x-Ray of sinuses.
3. Direct examination of esophagus (esophagoscopy).
4. Laryngoscopic examination.
5. Tests for hearing with labyrinthine examination.
6. Bárány chair tests to determine power of equilibrium.

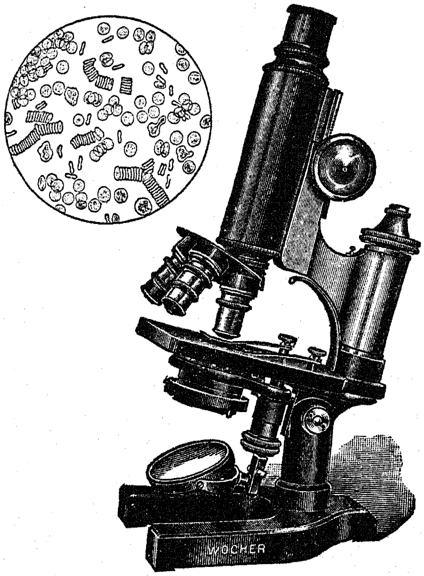


Fig. 39.—The microscope and a field showing red blood cells. (Funke.)

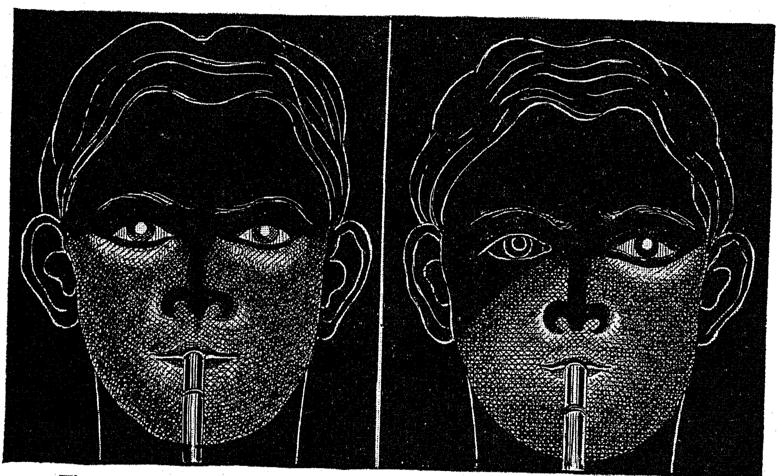


Fig. 40.—The left head above shows light coming through from the bulb placed in the mouth; in the right head the light is obstructed on the right side showing inflammation of the sinus below the right eye. (After Harmon Smith, in "Keen's Surgery.")

V. Examination of the condition of the genito-urinary tract:
1. Examination of urinary passage.
2. Examination of bladder (cystoscopy).
3. Catheterization of ureters.
4. Roentgenological examination of kidneys (Fig. 41), ureters, and bladder.
5. Renal function test (phenolphthalein).
6. Urine analysis from one or both kidneys.
7. Examination for gonococci, tubercle bacilli.
8. Smears.

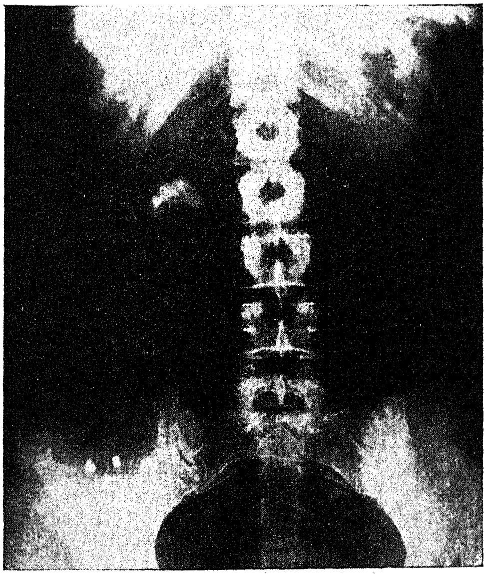


Fig. 41.—Stone in the kidney shown by the *x*-ray in the half-moon-shaped shadow to the left of the spine. Front view. (Waltman Walters, "Surg. Clin. of No. America," February, 1929.)

9. Examination for spirochetes by dark-field illumination.
10. Gonorrhea complement-fixation test.
11. Seminal fluid examination.

VI. Examination of the condition of the rectum and sigmoid colon:
1. Examination of rectum and sigmoid.
2. Roentgenological examination of bismuth enema.
3. Examination of mucus of rectum for ameba.

VII. Examination of the condition of the nervous system:
1. Complete neurological examination, including tests of reflexes, coordination, and association tests.

2. Spinal puncture with examination of the spinal fluid in
   (a) Wassermann test.
   (b) Cytology.
   (c) Globulin test.
   (d) Cultural examination.
3. Roentgenological examination of spine and cranium.
4. Muscle reaction of degeneration, response to different types of electrical stimulation.
5. Encephalograms of the lateral ventricles.

VIII. Examination of the condition of the endocrine system:
1. Test of the ability to burn carbohydrates in the body.
2. Roentgenological examination of sella turcica and thymus gland.
3. Basal metabolism.
4. Aschheim-Zondek test for pregnancy.

IX. Examination of the condition of special parts by manual means or supplemented by the *x*-ray:
1. Teeth for pus sacs.
2. Joint conditions, postural deformities, dislocations, and muscular weakness.
3. Bone conditions—especially for fractures and bone diseases.
4. Examination of the consistency of swellings.

X. There are other special tests, such as the great number of skin tests for protein sensitization, total nonprotein nitrogen test of urine, Widal test used in typhoid fever diagnosis, Schick test, Dick test, Lange's colloidal gold test, microscopical tests of the histology and pathology of tissue, type differentiation of the pneumococcus, and milk examination (human).

These examinations, I to X inclusive, are essentially laboratory tests. In addition, the use that scientific medicine makes of personal and family history, inspection, palpation, percussion, auscultation, and mensuration in the physical examination, is very great. With the aid given by laboratory findings the personal observation of the physician himself is corrected or verified.

It should be remembered that the letters M. D. after a name do not guarantee competency, intelligence, or integrity. The recent exposure of "diploma mills" should prevent such mistakes. Moreover, there are rascals, incompetents, and the lazy in every profession. In selecting counsel for health or disease one should have roughly three guides: character of the physician as a person; nature of training, scientific or not; and, nature and extent of experience.

The presence or absence of disease can only be determined by scientific methods. It is not possible that a person

untrained in the nature and course of disease can tell whether or not the human body is diseased any more successfully than a blacksmith can determine whether or not a Swiss watch is in need of attention. Both are able to detect whether or not the organism is performing its function, but neither the untrained person nor the blacksmith can determine what is the cause of the disturbance or the proper method to pursue to correct the condition. In these particular cases the only rational procedure is to secure the services of a properly experienced watchmaker in the case of the watch, and a properly experienced physician in the case of the human body.

While not all the items given above are necessary for the examination of any one case, patients should know when the physician is giving competent service. The day is past when disease can be determined by looking at the tongue; carelessness, indifference, or incompetence by the physician should not be excused.

That procedure is rational which bases its principles of action upon the demonstrated facts of living processes. Instruments of precision, such as the microscope, the *x*-ray, the chemical laboratory, and the technic of the scientific method, bring to the study of man, both in health and in disease, a record that can be proved by others working with like care and precision.

Man, the Organism.—It is important for physicians to understand and take account of the emotional and psychic factors in disease. Physicians as well as laymen need to remember that man is a unit of mind and body, and that it is fallacious to think of him in his reactions and expressions as purely physical or purely mental. Moreover, the factors that enter into the production of health must be completely evaluated. The psychical must be considered as well as the physical. This does not mean that one is to treat typhoid by mental rays and spiritual light, but it does mean that in the whole life of man he who would attain health, and he who would restore health, must know the forces that affect personality in its spiritual aspirations and be able to recognize the demands of the intellectual and

emotional life as well as those of the stomach and the intestines. There is an element of truth in most of the unscientific systems or cults that attempt either to teach health or restore health, but the mistake of the credulous lies in accepting as a guidance for the whole of life a lantern that casts its rays in only one direction, when an arc light is available. It should be remembered, therefore, that science cannot neglect the mind of the individual in dealing with the body (the physician must treat the patient and not the disease); various mental healers in ridiculous fashion neglect the body and its nature.

This influence of the mind over the body is one of the most admirable relations, and yet in the hands of the unscientific this fact is used with pernicious results. It is known that persons suffering from hopeless maladies are especially susceptible to the suggestion that comes from any new treatment with glowing promises. This psychic element in cancer, for example, has been well described by Weil:

> It is indeed very remarkable that a patient that has been consigned to death as a victim of a hopeless malady should regain his spirits and his appetite, when he is again confronted with the hope of a cure and of the eradication of his disease. It is a phenomenon well known to every student of the disease that a large proportion of cases responds in just this manner to any treatment that is offered them. Osler has described a case of cancer of the stomach in which the mere visit to a consultant of sanguine temperament, though poor judgment, whose assurance to the patient that there was no possibility of cancer, resulted in a disappearance of all symptoms and a gain of 18 pounds in weight. It is this psychic influence which has occasionally deluded the honest student of cancer cure, and which has also so generously played into the hands of the dishonest.

The science of health includes not only the physical but also the mental. As a science it has definite and accurate provisions for the attainment of health. The laws must be obeyed. They demand application in the lives of men and women and are most serviceable when guided by ideals and made a part of life by habituation. A life that is guided by the highest ideals in applying the scientific knowledge of the laws of health is the best illustration of artistic living.

To live most and to serve best may with more success be

achieved in this combination of ideals with science than in any other way.

The following chapters will present the essential laws of hygiene and conditions for health; the hygienic facts will be of service in so far as they are used.

QUESTIONS AND EXERCISES

1. Show that personal hygiene has a dual aspect.
2. List scientific sources of the laws of health.
3. To what extent should health habits be automatic?
4. State the characteristics of the modern scientific method.
5. Show that it is a more difficult problem to apply the scientific facts of hygiene to human living than it is to apply the scientific facts of metallurgy to steel making.
6. At what time and with whose work did modern hygiene and sanitation have their beginning?
7. Enumerate developments growing out of the above beginnings.
8. What was the second phase of science's effort to promote health and control disease?
9. What advances grew out of the above procedure?
10. Make a comparative study of the doctrine of asceticism, Berkeleian idealism and the scientific idea that body and mind are interdependent.
11. State the conflict between some unscientific notion of disease and the findings of science with regard to disease.
12. Show by statistics how diphtheria, typhoid, and smallpox have been controlled through preventive measures.
13. What types of disease may yield to psychotherapy? Explain. How may education solve this problem?
14. State the facts to show the essential differences between structural and functional diseases and account for the fact that treatment of the two types is different.
15. Contrast the occult with science.
16. Set up some scientific guides to be used in overcoming the influence of magic.
17. State the rational procedure of scientific medicine.
18. Set up guides which may be used in selecting a physician.

CHAPTER VI

HYGIENE OF THE MUSCULAR AND SKELETAL SYSTEMS

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II. Place of Movement in Human Development.
III. Significance of Movement and Consciousness.
IV. Habits of Muscular Activity Characteristic of Different Stages of Human Development.
V. Beneficial Effects of Rational Exercise:
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VII. Adaptation of Exercise:
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VIII. Relative Value of Different Activities:
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X. All the Factors in Health Important.

HYGIENE OF THE SKELETON

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V. Flatfeet.
VI. Exercise for Weak or Fallen Arches.
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HYGIENE OF THE MUSCULAR SYSTEM

Anatomical and Physiological Backgrounds.—One may learn how to live without a detailed knowledge of human structure and function. On the other hand, one may possess extensive knowledge of anatomy and physiology and still live badly. There is no cause and effect relationship

here. Nevertheless, for certain persons, an understanding of basic concepts in structure and function gives a background that aids in conviction regarding the necessity for hygienic practices.

The Nature of Cells.—Before the years 1838–1839 little was known regarding the composition of the human organism. For a long time, the notions of Aristotle prevailed and the idea of Hippocrates that four humors composed the human body was held well into the seventeenth century. In the third decade of the nineteenth century, however, two scientists, Schleiden and Schwann, published a treatise that

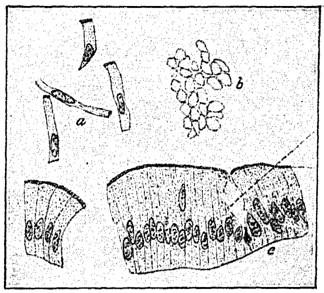

Fig. 42.—Simple columnar epithelium from the small intestine of man: *a*, Isolated cells; *b*, surface view; *c*, longitudinal section. (Böhm, Davidoff, and Huber.)

gave a description of the units of structure of living bodies, plants, and animals. These units were called cells (Fig. 42).

The cells composing the human are so small that a microscope is necessary to see them. They vary greatly in size and shape. Two chief parts are present, the central portion (nucleus) surrounded by the body of the cell (cytoplasm). There are numerous other structures of the cell that have been identified, but their functions are not known in each case.

Cells arise from cells. The individual person is a development from one cell (the ovum) that has been fertilized by another cell (the spermatozoon). Thus the fertilized ovum is an individual in the one-cell stage of development.

In the earliest stages of development the growing individual is composed of cells that are alike. One cell looks like another. As development proceeds, groups of cells begin to change their shape, size, and structure. This differentiation process results in the various types of cells that compose the fully developed individual possessed of muscle cells,

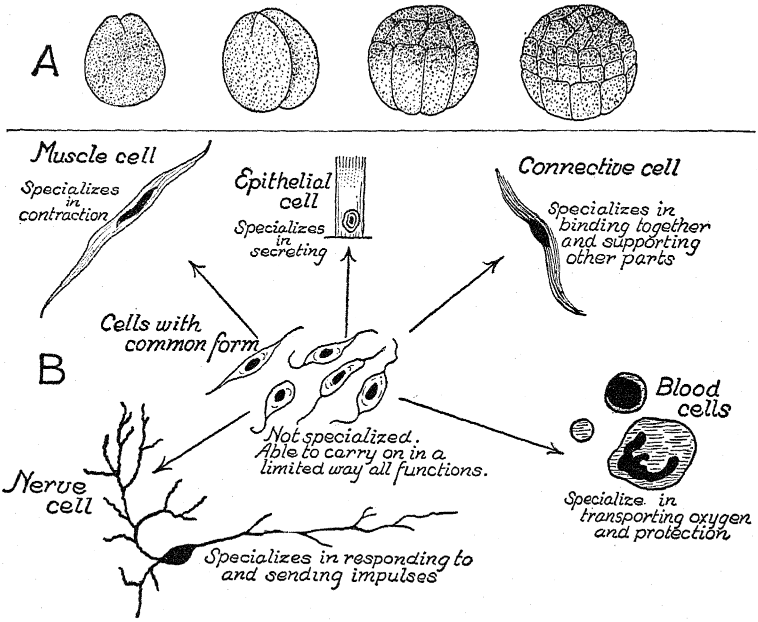

Fig. 43.—The diagram in A, the top row of structures, shows segmentation of a cell to produce a many-celled mass. B indicates five embryonal cells (in center) and the arrows point toward types into which they have differentiated. The specialization in function is indicated also.

nerve cells, gland cells, bone cells, blood cells, and numerous other types (Fig. 43).

This change in structure is a manifestation of change in function. The muscle cell now has specialized in contraction, the nerve cell in receiving and sending impulses, and the gland cell in secretion. As development proceeds, like

cells become organized into masses, called tissues that are arranged to form organs. These are now functional groupings, so that such a function as walking or thinking or breathing involves practically all types of cells and all types of tissues in the organism. That which at first appeared to be a mass of many individual cells is seen to be a marvelous unity of function produced by the unified units that correlated their activities one to another.

The study of the human organism by rigorous scientific method results often in a detailed descriptive analysis of its parts. Science breaks life into bits in order to discover its ultimate nature and composition. This attack is necessary but it frequently leaves the student of anatomy and physiology with the impression that any human function is the sole expression of the action of a particular group of cells. Thus, there are persons who regard the brain as the organ of thinking and while one cannot think without a brain, nevertheless, thinking is an expression of function of the whole organism. The tone of the muscles, the digestion of food, the secretions of glands, the elimination of waste—these influence the functions of the brain. Thinking, walking, breathing, laughing and numerous other functions are expressions of the whole organism and not of any single part.

Life goes on in the cells according to the ability of the cells to perform their functions. In cellular terms, it may be said that the level of life of an individual person is expressed in the activities of his cells.

Cells and the fluid substances between them are composed of extremely unstable material. Constantly changing in chemical character, they are subject to exceedingly rapid and pronounced alteration under the slightest disturbance. It is known that a momentary failure of circulation of blood in the brain causes a sudden cessation of consciousness, that is, of brain function. Although extremely unstable, cellular groups have learned through the ages to adjust so quickly to alteration of chemical content that the *appearance* of stability is given. The functions of various organs and parts in the body are to maintain constant the conditions of

the cell environment; when these are disturbed, to restore a balance. From this point of view then life is marked by a continual disturbance in cells and an effort by all groups of cells to preserve a balance.

A simple illustration will be given. When one runs, cellular activity of muscles produces acid chemical compounds that on entering the blood disturb a balance in the fluid. As the blood reaches certain cellular nerve groups in the brain, called the respiratory center, the acid excess stimulates the center and the runner breathes more rapidly and

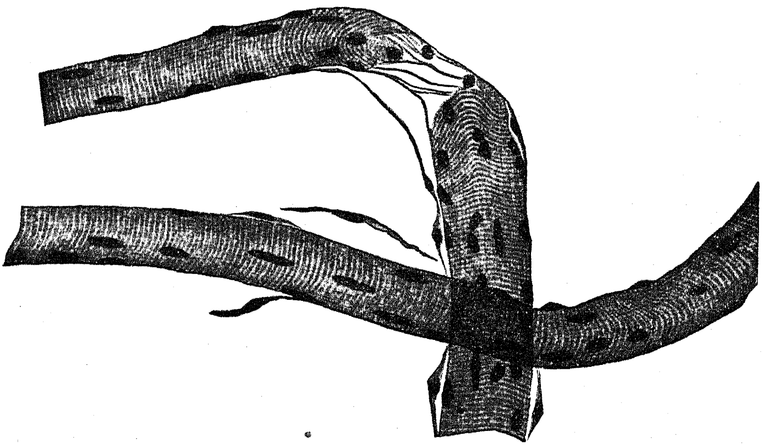

Fig. 44.—Two striated muscle fibers. 250 ×. (Maximow-Bloom.)

more deeply. The effect of this increased respiratory action is to eliminate these acid compounds (carbon dioxide) from the blood. As this is accomplished and the normal balance is attained, the breathing automatically adjusts to its normal rate. The running has upset the cellular balance, but throughout the body all cellular groups combine to restore it. Illustrations could be given in many common examples, as coughing, sneezing, shivering, and sweating.

The Nature of Muscles.—Muscles are composed of cells which possess unusual powers of contracting. This is an example of high specialization. No other cells contract as

effectively as muscle cells. There are three types of muscle cells that differ in shape and structure, but they are alike in the possession of this ability.

Muscles, composed of contractile cells (Fig. 44) exert their effects by moving parts to which they are attached or by compressing parts which they surround. When attached to bones (Fig. 45) the contracting muscle draws its two ends toward the center and one or both attachments move. Ordinarily one attachment remains fixed and one moves. When the muscle is in the wall of an organ, the contraction causes compression or movement depending upon the posi-

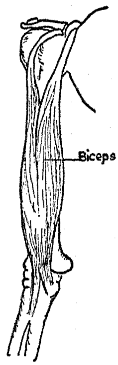

Fig. 45.—Muscles of the upper arm.

tion of the muscle cells. If arranged circularly, around a tube, as in blood vessel, small intestine, bladder, etc., the contraction compresses the tube; if arranged lengthwise, as in the large intestine, the contraction causes a movement of the sacculated segments. Interesting examples of muscle action are in the iris of the eye, the heart, blood vessels, stomach, bladder, arms, and legs.

The Contraction of Muscles.—The exact mechanism by which the cells contract is unknown. Various theories have been proposed and there exists a considerable amount of information regarding the chemical changes that take place in muscle during contraction. During activity fluid collects

in muscles and remains increased in amount (may be 20 per cent heavier) for some hours afterward. This accounts in part for stiffness after exercise. Pain after exercise may be due to oxygen want. Heat and massage by improving circulation in muscle are useful in overcoming stiffness and pain. They may do this by decreasing the swollen conditions of the part and by bringing more oxygen to the cells.

The Fuel of Muscle Work.—The work done by muscles depends upon chemical compounds that yield energy. The three classes of food, carbohydrates, fat, and protein contain chemical compounds that yield energy. While formerly it was believed that carbohydrate alone was utilized in muscle contraction, the evidence from numerous experiments, while somewhat contradictory, seems to show that carbohydrate and fat may readily be used and that protein in emergency may be involved in contraction. It appears from the evidence, at present available, that carbohydrate is the best source of energy for muscular work.

Growth of Muscle Power.—In general, use of a part strengthens and disuse weakens. This is notably true in the case of muscles. An increasing ability to do muscular work is found normally in those persons who increasingly require work of their muscles. It may be taken as axiomatic, then, that the way to gain muscle power is to spend energy in doing muscle work. This paradoxical statement is strikingly true.

Muscle Tonus.—Muscles when not actively working still maintain a condition of partial contraction, called tonus. It is an intermediate state between complete relaxation and a contracted condition. In muscles of the skeleton, tonus depends upon impulses from the nervous system and is a reflex phenomenon for if the nerves to a muscle are cut, the muscle becomes exceedingly flaccid. These impulses from the nerves arise in response to a wide variety of sensory stimulations, such as cold, postural positions, emotional situations, sight and sound waves. This condition of tonus is present also in plain muscles of the blood vessels, intestines and other organs.

Excessive tonus is known as tension and may result from

excessive stimulation or from strains and stresses upon the organism. Rathbone[1] says:

> . . . hypertension may be caused by many factors, among which lack of sleep, overwork, pain, a nervous constitution, and physical defects are important.

Fatigue of Muscle.—There are two types of fatigue; one that ensues from muscular work (Fig. 16), and one from mental activity. In the former, the muscles themselves show diminished power to do work; in the latter the symptoms are referable to the nervous system with inability to fix attention, impaired memory, slow reasoning and similar signs. Whether the mental type of fatigue is due to changes in nerve cells or is an expression of lowered powers in related parts is not known. Interrelationships between mind and body functions exist and hence excessive muscular effort may produce mental weariness; prolonged mental work decreases muscular power.

Individuals vary in their ability to resist fatigue. The factors are the constitution, habits of work, and ability to eliminate disturbing emotional factors. Appearance of fatigue varies with the type of work done and conditions of the environment. Rhythmical movements are less fatiguing than stiff, interrupted patterns; skilled work is usually more wearing than unskilled labor probably because of the greater attention required; and uninteresting tasks are more fatiguing than absorbing ones. Environmental factors in fatigue are poor lighting, poor ventilation, noise, high temperature, and excessive humidity.

Muscle Sense.—Nerve impulses from muscles convey to the individual information regarding the extent of contraction, the location of parts moved, and the amount of stress employed. The judgment of weights is a simple illustration of muscle sense. One cannot know what a correct movement is until one makes it—just as one cannot know what play is until one has played. This knowledge from experience is in part derived from muscle sense (Fig. 46).

[1] Rathbone, J. L.: Corrective Physical Education, W. B. Saunders Co., Philadelphia, 1934, p. 117.

What Are Ligaments and Tendons?—Ligaments are bands of tissue composed of cells that are exceedingly tough and inelastic. They appear mainly as supporting bands that bind two bones together at a joint. Common examples are the ligaments of the ankle, knee, and elbow joints. These bands permit motion within a certain range that is normal for the joint (Fig. 47). When movement passes beyond

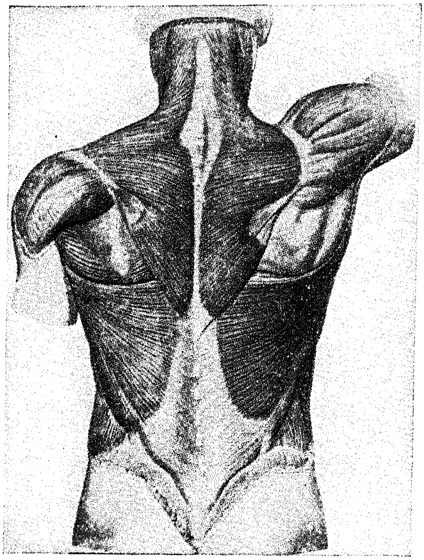

Fig. 46.—The muscular system of man requires exercise not only for its own normal function but for the welfare of the entire organism. The illustration above shows muscles of the back. (Sobotta.)

that normal limit, the ligament is torn or in popular phrase the joint is sprained. A sprained ankle is a tearing of some of the cells of the ligament of the ankle.

All ligaments have their particular functions to perform. These depend upon the joint and the demands made upon it. One ligament of very great importance gains prominence because of the strain placed upon the foot in supporting the weight of the individual. In Fig. 48, the bony structure

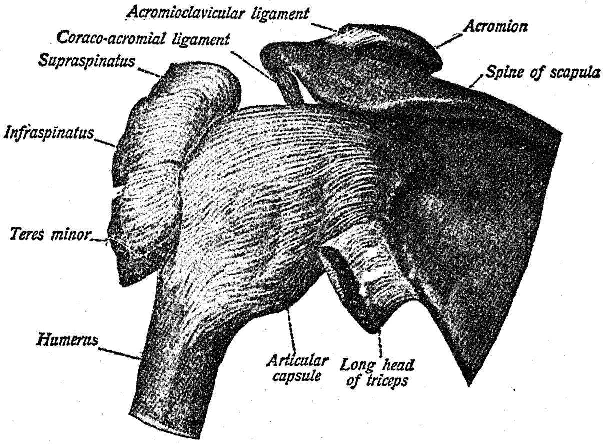

Fig. 47.—The left shoulder joint seen from behind, the long head of the triceps being cut and the terminal portions of the supraspinatus, infraspinatus, and teres minor muscles cut and turned outward. (Sobotta and McMurrich.)

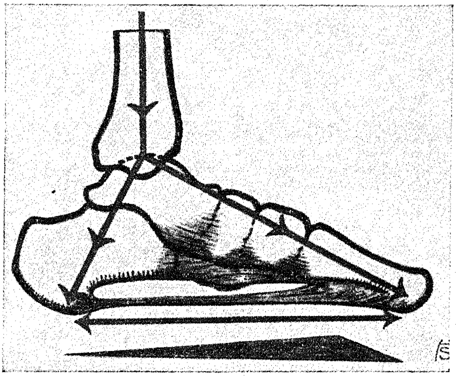

Fig. 48.—Diagram of the bones of the foot showing also the long plantar ligament. (S. Mollier.)

of the foot is shown. The different bones are arranged in the form of an arch with the leg bones bearing upon the rear portion of the arch. It will be noted that a ligament (the

long plantar) runs from the heel bone forward to attach to several bones of the arch. This ligamentous structure functions in helping to maintain the arch; muscular action is also a factor.

The use of the foot by improper walking, or wearing high heels, to mention common abuses, places such strain upon the foot muscles and the plantar ligament that the arch is broken and the foot loses a large part of its power to function. Preservation of good structure is essential to maintenance of the best function.

A tendon is composed of cells similar in type to those of a ligament; but they are packed more closely together into a very firm and strong band that attaches muscles to bone. Tendons are sometimes torn but since they are exceedingly strong, the muscle, in severe movements, usually tears before the tendon.

Plan of the Skeleton.—Simply stated the skeleton may be viewed as a central structure, the vertebral column, on top of which rests the skull, and to this central axis are attached the ribs forming the thorax, the shoulder girdle with arm bones, and the pelvic girdle with leg bones (Fig. 49). In detail it is far more elaborate than this, but as the frame of a house reveals something of the more elaborate structure which rises around it, so this simple skeletal frame corresponds rather definitely to the complex human structure.

The Vertebral Column.—The vertebral column is composed of 24 separate vertebrae that extend from the sacrum to the skull. These separate bones allow for movement of the spine. It should be understood, however, that these separate bones are bound together into a flexible column by many strong ligaments. Contrary to beliefs held by some persons, these vertebrae are not easily displaced. In fact it is very difficult to dislocate them in any region except in the neck (Fig. 50). Dislocation may be caused in severe accidents, but otherwise such injury is quite uncommon.

The Skull.—The skull is the bony structure of the head. In its upper and back portion rests the brain; in its front portion, called the face are the endings of important nerves from the brain that give to the individual a tremendous

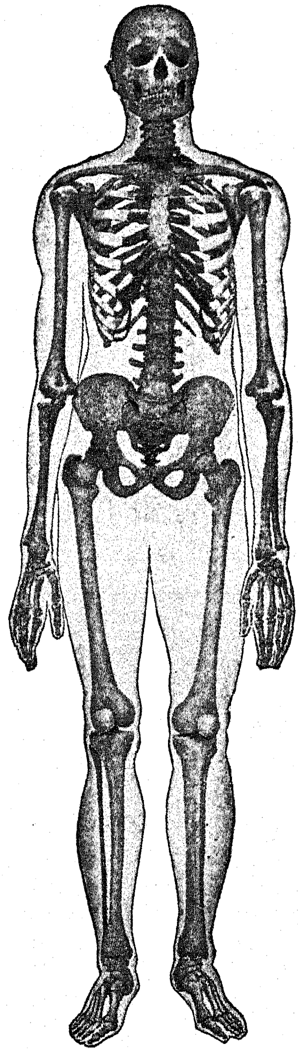

Fig. 49.—Photograph of the skeleton, with outline, of a man age thirty-seven years; height 6 feet, 1 inch. (From McClellan's "Anatomy in Its Relation to Art.")

amount of information regarding his immediate environment. Some of the bones of the skull contain cavities between their walls that are called sinuses. These bony sinuses connect by passages to the nose and throat; they are lined with mucous membranes that are continuous with the membranes of the nose and throat. It is this arrangement that allows infections to extend from nose and throat to the head sinuses. Sinus infection is common, but there is nothing mysterious about it. Infected membranes of nose and throat are directly connected with membranes of the various sinuses. The sinuses frequently involved in infection are sphenoid, ethmoid, and maxillary (Fig. 51).

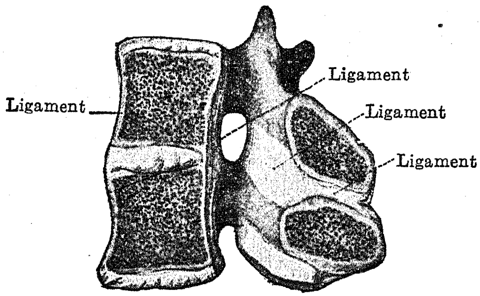

Fig. 50.—Two thoracic vertebrae divided longitudinally in the median line. Notice how they are bound firmly together by ligaments. (Sobotta and McMurrich.)

In adult life the bones of the skull are solidly bound together in points marked by interlocking teeth. In infants at birth, however, there are spaces between the bones of the cranium that allow adjustment of the shape of the head to the pelvis, and permit rapid growth of the brain during infancy. These "soft spots" of the head of the infant are technically called fontanels. They close completely at the end of the second year of life.

The Thorax and Shoulder Girdle.—The thorax or chest of the skeleton provides a bony cage for the heart and lungs. It is formed by 12 pairs of ribs that attach behind to the vertebral column and swing forward to meet above at the

breast bone (sternum). The lower ribs do not reach the midline but taper off in length making a receding line that curves from the sternum downward and laterally.

The shoulder girdle is composed of two bones, the shoulder blade (scapula) behind and the collar bone (clavicle) in front. The scapula attaches to the clavicle at the site of the shoulder. The clavicle extends toward the midline and

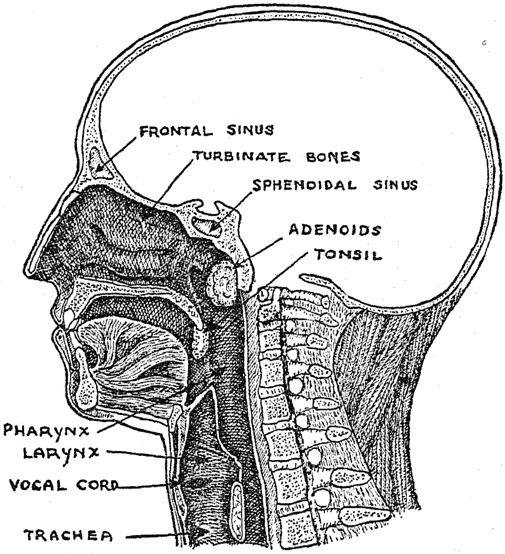

Fig. 51.—Section view through the head showing respiratory passage way with location of adenoids, tonsil, sinuses, and turbinate bones indicated.

articulates with the sternum. This is the only attachment with the frame of the skeleton. The arrangement provides for great freedom of movement of the arm.

The arm possesses one bone (humerus) in the upper portion and two (radius and ulna) in the lower. The humerus and scapula form the shoulder joint. The radius is arranged to turn around the ulna as shown in supination and pronation of the hand.

The wrist is composed of 8 small bones in two rows; below these are the 5 skeleton bones of the hand to which the small bones (phalanges) of the fingers and thumb are attached. Examination of the hand will reveal the 5 long bones of the palm, and in addition one may detect that there are 3 phalanges in each finger and 2 in the thumb.

The Pelvis.—At the base of the vertebral column, the last vertebra rests upon a triangular-shaped bone, the sacrum; below this is a group of degenerated vertebrae, the "coccyx." Swinging laterally from the sacrum are two irregular bones that meet in front in the midline to form the pelvis. This structure contains several important organs, such as the bladder, sigmoid, and in the female the uterus and ovaries in addition. It gives a base for the attachment of the leg bones.

The lower extremities are similar in their bony plan to the upper. There is one large bone of the thigh (femur) similar to the humerus, and two of the leg (tibia and fibula) similar to the radius and ulna. The knee joint is quite different in type from the elbow. The ankle bones, comparable to those of the wrist, are seven rather than eight in number and are much larger. They make up most of the part commonly called the foot, composing the heel and about half of the long arch. The forward part of the foot and toes resemble the hand and fingers and thumb in plan.

The upper and lower extremities are much alike in structure; they are immensely different in function. The hip joint is much less movable than the shoulder, but stronger and more suited to bear weight. The foot is larger and stronger than the hand but not so facile and dextrous in movement.

The Skeleton a Living Structure.—Bones are living structures constantly changing in shape and size in response to the stresses and strains upon them. Within the cavities of the long bones is a fatty substance, the marrow, which is the seat of red blood cell formation. In youth the bones are more readily altered in shape than in adult years and this is the favored time to determine the kind of frame for your house, so far as posturing and exercise may affect the skele-

ton. But the skeleton is not a lifeless affair. Within certain limits, one may have the kind of bony physique one desires. These limits are real of course and are marked by inheritance; but food and use are important factors in building the skeleton.

Size and Shape of Bones.—Bones vary in size and shape. Size varies with age, sex, and individual. The shape of a bone corresponds to its use in the skeleton, and reflects the nutrition of the individual and the work done. Malnourished children may acquire crooked and deformed bones—rickets is a common cause of crooked legs, deformed chest, and even facial and cranial distortions. If one does considerable physical work the muscles attaching to bones produce marked roughened places as a result of the muscular pull upon the skeleton. These changes serve to strengthen the bone.

In the embryo, structures that are to become bony appear first in a softer tissue, cartilage or membrane. From this early pattern bone is gradually formed. Complete bony formation, however, does not exist until about the twenty-fifth year, although most of the skeleton has become bony in character long before that. This quality of the bones emphasizes the fact, however, that change in shape of the bone before maturity may be secured but that after twenty-five years of age, change is almost impossible.

How Bones Grow.—Bones grow in length and in breadth or circumference. In long bones, growth in length takes place at an area between the extremities and middle part of the bone. Growth in circumference occurs by a deposit of bone on the outside and destruction of bone within the marrow cavity (Fig. 52), giving a larger and stronger structure without greatly increasing the weight. Stresses on bones during the growth period influence their shape.

Fractures.—Broken bones are called fractured bones. A fracture may only split the bone or may completely separate the parts. A fracture is "set" when the broken parts are placed in normal position. After a fracture the injury is repaired by bone cells that arrange themselves around the injury and later lime salts are deposited. The new formation is called a callus.

Joint Dislocations.—When joints are sprained, ligaments are torn. The injury may be quite painful but the bones of the joint remain in their normal position. Sometimes the injury is severe enough to displace one of the bones; this is a dislocation. If the ligaments are excessively loose, this may occur without much injury to them, but since such abnormal looseness is rather infrequent, dislocations usually produce a good deal of injury to the surrounding soft parts.

Place of Movement in Human Development.—We have seen that the simpler forms of life were concerned almost entirely with the processes of getting food and reproducing their kind. In the very simple types these functions were carried on without any directive force. Food came mainly

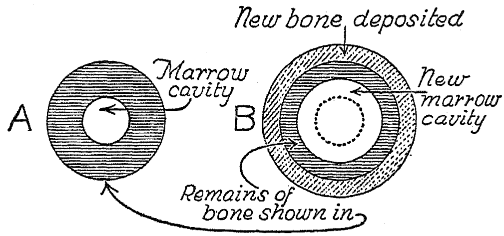

Fig. 52.—Diagram to show how a long bone grows in circumference. A, Cross section of a long bone. B, Cross section of bone that has deposited new bone and enlarged the marrow cavity.

from the surrounding media and was taken in by a process of absorption. Reproduction as a process was very simple. It consisted in the adult dividing and producing two where there was only one before.

The lowest wormlike animals gave apparently the first appearance of a muscular system and there followed soon after this a skeleton. Mollusks developed an external covering which limited locomotion, and it was not until the bony parts became elaborated as an internal skeleton that locomotion as seen in mammals came into prominence. The vertebral skeleton opened up tremendous possibilities because great masses of muscles could thus be used, and, in addition, there came increased opportunity for the nervous system in a rapidly changing environment. It is very

important for us to understand this simple fact of development, because in our own training of the human being we should align our methods with the methods used by nature in developing man and thus work in harmony with nature's laws. The increased efficiency of the nervous system that followed the increased power of the organs of locomotion means for us today that we should emphasize and develop the muscles and skeleton before we attempt any serious training of the nervous system. Moreover, we can expect the nervous system to work most effectively if the muscular system is well organized and in good condition, and if the skeletal system is in such posture as to maintain proper functioning. It is an interesting and important fact that the attitude of the individual person and the functioning of the brain are controlled and modified by the position of the body as a whole and by its several parts; and the use of the nervous system, as pointed out by James,[1] to insure that every sensory stimulus shall result in a muscular or motor response suited to the emergency, shows the mutual reliance of these two systems upon each other.

Significance of Movement and Consciousness.—It is very interesting that the story of development of higher forms of life in the animal and plant kingdoms associates, in general, in the former, consciousness and movement, and in the latter, unconsciousness and immobility.[2] For the animal a muscular system made movement possible and locomotion gave opportunity for new and changing situations. The stimulation of the sensory part of the nervous system was tremendous and called forth increased neural activity. Consciousness, therefore, has been associated very definitely with movement.

It is significant in this connection to note that modern psychology is affirming this biological fact in its statement that sensation is never complete until the centrally initiated impulse is expressed outward in a motor way and is returned

[1] James, William: Psychology, Henry Holt & Co., New York, 1900, pp. 370–372.

[2] There are some exceptions, notably the Drosera (Sundews) and the Dionaea (Venus' fly-trap).

with the significance of the act rounding out the circle and completing the circuit.

Moreover, the meaning of motor training must be viewed in this newer light. The training of the hand in kinesthetic sense, the training of trunk and legs, means an awakening

Fig. 53.—A well muscled young man whose education has provided opportunity for physical activity. (Courtesy of Riebicke, Berlin, Germany.)

of consciousness with reference to the physical world that is extremely valuable (Fig. 53).

In contrast with this interesting development in the animal world there should be noted the characteristic immobility of the higher plants and its accompanying unconsciousness.

Consciousness and movement have been associated in development; consciousness and movement are to be associated now because of the history of man. This means definitely—does it not?—that intelligence will not develop fully in the sedentary and immobile individual. The brain has evolved concomitantly with vigorous activity of the muscular system.[1] Mental power and physical ability seem quite unrelated as we think of individuals in some pugilistic and athletic fields, and yet it is a fact that individuals of defective mentality often exhibit motor deficiencies. Wertham[2] in a study of 923 patients with mental disorders, draws a parallel between mental and physical disturbances. Twenty-one per cent of his cases showed growth disorders, and in some groups it ran as high as 36 per cent. He says that one group "frequently show in their prepsychotic mental development traits of unharmonious growth and combinations of mental precocity and arrested development in intellectual, emotional, and instinctive life." This does not mean that one can hope to attain brilliance of intellect by gaining increasing power to lift heavy dumb-bells. Mental power is gained and conserved by an intelligent care and provision for the physical activities of the body. The law of mental growth follows closely the law of physical growth.

There is a widespread impression that those persons who should be familiar with the fundamental principles that make for human well being are all too often indifferent to their implications. Scholars in many walks of life are often assumed to be forgetful of the adage *mens sana in corpore sano*. Alěs Hrdlička[3] reports on the measurements made of 100 members of the National Academy of Sciences. This is a selected group of high class brain workers. The report

[1] Beyer, H. G.: *American Physical Education Review*, June, 1900, p. 149; June, 1901, p. 181. *Report of the Royal Commission on Secondary Education*, 1905, London. Hastings, W. W.: *American Physical Education Review*, March, 1900, p. 53. Porter, W. T.: *Transactions of the Academy of Science of St. Louis*, 1893 and 1894. Christopher, W. S.: *Annual Report of the Board of Education of Chicago*, 1898–1899.

[2] Wertham, F. I.: *Archives of Neurology and Psychiatry*, May, 1929.

[3] Hrdlička, Alěs: Measurements of One Hundred Members of the Academy and What They Show. *Science*, May 10, 1929.

shows that men examined with rare exception are in no way inferior but rather superior in physique, strength, health, and longevity as compared with the American and even the Old American population at large.

Habits of Muscular Activity Characteristic of Different Stages of Human Development.—The muscular movements of the newborn babe are very limited in type and in amplitude, and as they increase in number and range up to adolescence, there is one characteristic manifestation. The movements of the child are large movements and the control over the trunk is more accurate and comes earlier than the control over hands and feet. The reason for this is to be found in the order of development of these muscles. The first muscles to appear in animal life were the muscles of the trunk; muscles of the upper and lower extremities came much later. The trunk muscles are, therefore, older, and in each individual of the race of man they develop first and are followed by the muscles that accomplish fine coordinations. Moreover, it will be recalled that the vital organs of life developed in correlation with the trunk muscles. This fact has tremendous connotation in ordering our lives with reference to the development of strong vital organs.

After adolescence the increased power of the individual to perform fine coordinations with the hand goes along with the increased power to coordinate the activities of the brain. The changes that have come in man's civilized environment require the use of the smaller muscles of the body. These changes threaten his vitality because they eliminate very largely the fundamental muscles that are so important in maintaining the health and strength of the circulatory, respiratory, digestive, excretory, and nervous systems. Moreover, these changes have added to the ease with which man can obtain a livelihood because of the ever-increasing use of machinery requiring only the pushing of a button for operation. In short, the life of man in the factory and even to some extent on the farm is more and more becoming what it has been for the clerk for many years—a sedentary life. Such alterations in the life of man bring advantages in many ways, but unless their limitations are understood and

controlled both by the individual and the community the result will be definitely a loss of vitality to the nation. We can never put the nation back to spinning wheels for the women and flails for the men.

Fig. 54.—Bobby Jones has in golf a means of recreation that is rarely recognized because of the prominence given to his achievements in the game. (Underwood and Underwood.)

Since the life of many civilized men is and will be in the future a life in work of sedentary type, effort should be made to understand this fact and then to work out types of activity that will provide the margin of motor activity

that man requires to maintain his own health and that of the race (Fig. 54). Professor Hetherington[1] has outlined in valuable form (Table II) what is needed from five to eighteen years.

After twenty years of age an hour should be given daily to motor recreation involving the use of the large muscles of the body. Anything less than that for most individuals will

TABLE II

DISTRIBUTION OF ACTIVITIES BY AGE PERIODS

Age	Total Average Waking Hours	Big Muscle	Manual	Linguistic	Automatic	Doing Nothing
0–1	.....	....	....	....	....	...
1	9–½	....	....	....	....	...
2	10–½	....	....	....	....	...
3	11–½	....	2	....	2	?–
4	12	....	2	....	2–¼	?
5	12–½	4–½	2–¼	2–½	2–½	?
6	12–¾	4–¾	2–¾	2–½	2–½	?
7	13	5	3–½	2+	2–¼	?
8	13–½	5–½	3–¼	2–¼	2	?+
9	13–¾	6	3–¾	2+	2	?
10	14–	6	3–½	2–¼	2+	?
11	14–	5–⅔	3–½	2–½	2	?
12	14+	5	4	3	2	?
13	14–½+	4–½	4	3–¼	2–¼	?
14	15	4+	4–½	3–¾	2–½	?+
15	15–½	4–	4–¾	4	2–¾	?
16	15–¾	3–½	4–¾	4–½	2–¾	?
17	16–	3+	4–¾	4–¾	3–	?
18	16	2–½	5–½	5–	3	?
19	16	2	5–¾	5	3	?
20	16	2	5–½	5–½	3	?

The school years, from 5 to 16, are the strategic years for growth and development. The child requires muscle activities from four to six hours in this period. (By courtesy of Clark W. Hetherington.)

result in physical deterioration. We are unable to state the ideal degree of muscular development needed by man in different avocations. Theoretically, the lawyer, the doctor, the merchant require a less vigorous musculature than the farmer, mechanic, or day laborer. In reality, this may not be true when viewed in terms of fullest health and most

[1] Hetherington, Clark W.: *American Physical Education Review*, May, 1917.

satisfying happiness. Certainly, all men require a minimum physical development which would enable them to participate with pleasure in many forms of motor recreation. The narrow view that conceives man as giving all to vocation and only a pittance to recreation for "exercise" constricts the range and scope of human happiness.

Fig. 55.—Strength and skill should be sufficient in an activity to permit one to take satisfaction in performing the activity. Helen Meany dives well enough to enjoy it. (Underwood and Underwood.)

This minimum physical development should provide for all:

1. Strength of trunk muscles to maintain an upright posture and to prevent any ptosis of vital organs.
2. Strength of back and leg and feet muscles to produce:
   (*a*) Ease and elasticity of gait.
   (*b*) Power for walking, running, and jumping.
3. Strength of arm and shoulder muscles sufficient to

swing with reasonable skill a golf club, axe or racquet, to throw a ball, to row a boat or to paddle a canoe, to pull a rope, to control a horse, and to swim. Strength and skill should be sufficient to permit one to enjoy and to take satisfaction in such activities (Fig. 55).

Such a minimum, though generally stated, would provide power for enjoyable motor activity. It would insure against the ptoses of adult life. It would tend to maintain at normal the vital organs of the body.[1]

Beneficial Effects of Rational Exercise.—By rational exercise is meant exercise that is suited to the individual's need. What is desirable activity for one person may be unwholesome for another. Suitability of exercise is determined by the following.

1. The exercise for general effects should be natural. Through a long evolution man has developed a physical body in response to certain activities and needs. This body so developed will function best if exercised in movements similar in type to the activities that produced the body of man. Walking, running, jumping, lifting, throwing, striking, hanging, and climbing are natural types.
2. The exercise for special effects may be artificial, that is, designed to produce particular muscle action without reference to evolutionary prototypes. Thus, special corrective exercises for feet, spine, abdomen, chest, back, or other part of the body may be needed.
3. Whether natural or artificial, rational exercise will not produce soreness or stiffness. The idea that an exercise must hurt in order to be effective is similar to the idea that a medicine must have a disagreeable taste and an unpleasant odor in order to be potent. That exercise is most scientific which produces increasing amounts of fatigue substances, causing increased resistance to fatigue, but at no time resulting in soreness and stiffness.

[1] Friedman, H. M.: Muscular Development, etc., *Journal American Medical Association,* March 9, 1912, pp. 685–690.

With these brief reservations in mind the beneficial effects of rational exercise may be stated. They are:

1. Increased circulation through the part (as in special corrective work) or through the entire body. This circulatory activity carries food to the tissues, removes waste, distributes the endocrine secretions, and equalizes the water and heat content of the body. Not all persons respond in the same manner to exercise. Meek and Eyster[1] show that the heart responds differently in various individuals.
2. Increased respiration that gives increased oxygenation of the blood, increased elimination of carbon dioxide, and increased oxygen supply to the tissues. These values are dependent upon body activity and do not flow from the respiratory movement itself.
3. Increased elimination of waste through kidneys, lungs, intestines, and, to some extent, skin.
4. Increased metabolic changes. Digestion is improved, assimilation accelerated, and nutrition in general heightened.
5. Increased neural activity, resulting in part from the increased circulation and elimination, and in part from the awakened kinesthetic senses.

General Effects.—In vigorous activity there is an increase in the force and rate of the heart, the respirations are increased in depth and frequency, perspiration becomes more marked, and more waste is eliminated. There is in this heightened activity of the body systems a more or less complete change in the liquid of the body. Combustion of chemical compounds in the cells releases new energy; old accumulations of waste are removed and all the mechanisms for action are put in tune. Even reflective states are assisted by exercise, although if carried to the point of fatigue, mental activity afterward is slowed down. The scientific use of exercise involves the selection of forms and the extent of action that will favor best the particular somatic result desired. The teacher or leader of physical

[1] Meek and Eyster: Circulatory Adaptations to Exercise, *Journal American Medical Association*, March 31, 1923, p. 920.

education must be awake to all the possibilities here, and not prescribe exercise without careful determination not only of the individual's condition but also of the program and duties and responsibilities that are to be met after the exercise is finished.

Exercise stimulates growth.[1] Growth is influenced by heredity and environment. Henderson in a study of East Africans cites exercise and sunlight as factors.[2] Numerous observations confirm this statement. For the growing child this is essential. Contrariwise, overindulgence in athletic sport may so deplete the body of vitality that growth is retarded. Some of the most significant illustrations in the high school confirm this, notably overtrained athletes.

Exercise is most popularly known for its development of muscles. More significant is its power to develop the organs of the vital systems. In this achievement, exercise stands alone as the only agent. It must be remembered, though, that only certain types of exercise achieve this result: types involving the use of the fundamental muscles. German and Swedish gymnastics and other formal systems that seek certain postural, localized, and static effects are not valuable in this sense, though for special conditions they may have a certain limited use.

The body should be as sacred as a temple. Too often bodies are mere shells, wrecks that serve to house minds that have developed enormous receptive power, but minds lacking in power of initiative, wanting in force, direction, and enthusiasm. Persons of such unfortunate equipment do not have that quality of health that would enable them to live most and to serve best.

Injurious Effects of the Sedentary Life.—A life of sedentary living brings with it some real dangers to the vital organs of life. It must be remembered that for the best functioning of the whole man the physical and the psychical must be provided for, not only because a fuller life can

[1] Hall, G. S.: Adolescence, D. Appleton & Co., New York, 1911, pp. 1–237.

[2] Henderson, J. M.: Growth and Nutrition, *Kenya Medical Journal*, Nairobi, East Africa. Abs. Current Medical Literature, *Journal American Medical Association*, July 16, 1927, p. 249.

be lived in that way but also because without the physical the very basis of the psychic is lost. It is not unusual to see an individual unduly neglectful of his physical life so that he can advance in his vocation. More of health is traded for the rewards of sedentary work than is biologically desirable.

The Heart.—One of the first organs to feel the loss in strength is the heart. It must be remembered that the heart is strengthened by the exercise of the skeletal muscles of the body.[1] The only way in which a weak heart is to be made strong is by gradual and increasing amounts of physical work of the skeletal muscles. Studies of athletes show that the increase in size of the heart parallels the bodily exertion. This is true for other animals. In the hare the heart is three times as large as in the caged rabbit. The college or high school boy or girl who seeks to escape the activities of the physical education program because his or her heart is weak and irregular is foregoing the only means of obtaining a strong and regular heart. The persons who are unable to run a city block or climb a hill because of palpitation of the heart muscle, are the ones who are handicapped not only as regards this particular type of activity but also by the deficiency of the circulation to the entire body for twenty-four hours out of each day. The number of people who are just below par because of heart weakness experience inefficiency and debility as compared with efficiency and strength. Instances may readily be cited of individuals who have done and are doing fine and excellent work with impaired hearts. The evidence is incomplete. Its consummation would tell of breakdowns under extra heavy pressure, of times of lowered power, and of an almost constant fear that by "overdoing" a break would come. The surest and best way to condition oneself for the doing of a high type of work is to make sure so far as possible of a strong and efficient heart and circulatory system.

The Lungs.—Other organs that feel the loss of active exercise are the lungs. The function of the lungs in part,

[1] Tyler, G. M.: Growth and Education, Houghton Mifflin Co., Boston, 1907, Chap. II.

is to bring oxygen into the blood in response to the needs of the body. During increased activity, when great amounts of oxygen are needed, the lungs respond by frequent and deep respirations. The venous blood in the lung capillaries is exposed to air of a high oxygen content. There is no provision for the storing up in the lungs or in the body of oxygen for some future needs of the body. Oxygen burns

Fig. 56.—Miss Fritzi Burger of Austria. Abundant vitality expressed in joyous activity of body-building value. (Rathbone.)

(oxidizes) food materials as soon as it reaches the cells. Persons who live sluggish lives use the lungs relatively little because natural respiratory activity is automatically controlled by the needs of the body (Fig. 56). This defect cannot be overcome by such a makeshift as "breathing exercises," because oxygen is only delivered to the cells in accordance with their needs. The only rational way to provide adequate oxygenation for the cellular materials of the body

is by engaging in big muscle activity that results in deeper breathing without any control or direction on the part of the performer.

The Muscles.—As might be expected, the muscles of the body suffer in a direct way from the lack of activity. This

Fig. 57.—Skiing is a thrilling sport. It requires physical courage in addition to motor ability of a high order. One with weak muscles cannot engage successfully in this kind of activity. (Courtesy of Ufa, Berlin, Germany.)

is of little importance for health purposes as regards the muscles of the face; it is supremely important as regards the muscles of the trunk. The abdominal muscles play an important part in the maintenance of an upright posture and

a slackness and weakness of these muscles results in a weak standing position (Fig. 57). A weak posture shows an exceedingly unattractive body, and, in addition, has serious effect upon the position and functioning of the abdominal organs.

Adaptation of Exercise.—Exercise should be adapted to age, sex, occupation, climate, and the individual himself.

To Age.—In speaking of exercises for infants, Holt[1] says:

> This is no less important in infancy than in later childhood. An infant gets his exercise in the lusty cry which follows the cool sponge of the bath, in kicking his legs about, waving his arms, etc. By these means pulmonary expansion and muscular development are increased and the general nutrition promoted. An infant's clothing should be such as not to interfere with his exercise. Confinement of the legs should not be permitted. In hospital practice I have often had a chance to observe the bad results which follow when very young infants are allowed to lie in the cribs nearly all the time. Little by little the vital processes flag, the cry becomes feeble, the weight is first stationary, then there is a steady loss. The appetite fails so that food is at first taken without relish, then at times altogether refused; later vomiting ensues and other symptoms of indigestion. This in many cases is the beginning of a steady downward course which goes on until a condition of hopeless marasmus is reached . . . Infants who are old enough to creep or stand usually take sufficient exercise unless they are restrained. At this age they should be allowed to do what they are eager to do. Every facility should be afforded for using their muscles. Exercise may be encouraged by placing upon the floor in a warm room a mattress or a thick "comfortable," and allowing the infant to roll and tumble upon it at will. A large bed may answer the same purpose.

In the recommendations of Holt may be seen the principles which may effectively govern all children in the matter of exercise. There should not be undue restraint. The young child will run and play like all the young of animal life if it is not interfered with by certain conventions and social burdens placed upon the child by a thoughtless parent. The child who walks in the park with a nurse in order to advertise the social position of the parents, or is not permitted to play because of the danger of soiling kid gloves or fine dresses, is in serious danger. Such a child needs to be saved from his parents. It should be remembered that the child of the wealthy suffers just as severely, if not so fre-

[1] Holt, L. E.: Diseases of Infancy and Childhood, D. Appleton & Co., New York, 1911, p. 7.

quently, as the child of the poor man from lack of nourishment of the body cells. The difference is that the rich child has plenty of opportunity for food, but lacks the capacity for digestion and assimilation; the poor child could digest and assimilate if adequate food were available.

In speaking of exercise for older children Dr. Holt[1] says:

> In older children every form of outdoor exercise should be encouraged—ball, tennis and all running games, horseback riding, the bicycle, tricycle, swimming, coasting, and skating. Up to the eleventh year no difference need be made in the exercise of the two sexes. Companionship is a necessity. Children brought up alone are at a great disadvantage in this respect, and are not likely to get as much exercise as they require. The amount of exercise allowed delicate children should be regulated with some degree of care. It may be carried to the point of moderate muscular fatigue, but never to muscular exhaustion. The latter is particularly likely to be the case in competitive games.
>
> Exercise should have reference to the symmetrical development of the whole body. In prescribing it the specific needs of the individual child should be considered. By carefully regulated exercises very much may be done to check such deformities as round shoulders and slight lateral curvatures of the spine, and also to develop narrow chests and feeble thoracic muscles. For purposes like these gymnastics are exceedingly valuable to supplement out-of-door exercise but they can never take their place.

It is important to point out here that Dr. Holt is speaking of the child with physical defect when he recommends symmetric development. There is no reason to believe that he means the symmetry in body development that was sought so earnestly a few years ago by specialists in anthropometry. The child that is allowed to participate in all vigorous games will develop symmetrically enough to satisfy all except those who make symmetry a fetish to be worshiped.

During the period of adolescence, when the body is growing rapidly and the vital organs are embarrassed to keep up the supply of energy for the rapidly growing body, it is important not to carry the exercise to extreme lengths. It should be remembered that in children the one quality that should not be tested is endurance. Many instances are on record of high school athletes being "burned out" by too intensive participation in scholastic sport. Exercise should

[1] Holt, L. E.: *Loc. cit.*, pp. 7, 8.

be used to build strength and power in the youth, not to waste them.

Exercise for Adults.—Adults in general suffer from lack of exercise. The vocational interests of the majority of men and practically all women tend to center in sedentary activity. The adult has not carried on his interest in motor activities because of two defects in his training:

1. The formal calisthenic training of school days offered no satisfying states and hence no habituation to exercise that would make for continuance after school days.
2. The athletic games and sports learned in school were so highly organized and required such expensive and elaborate equipment that they were not pursued.

Scott[1] in a study of the place of physical education in the lives of one thousand business men shows the following:

1. About 50 per cent follow a regular program of physical activity.
2. Period of greatest participation is between thirty-six and fifty years of age; next greatest period is over fifty years and the least between twenty-five and thirty-five years.
3. About 83 per cent consider the ability to play a game or take part in physical activity a necessary part of their professional equipment; 9 per cent consider it desirable but unnecessary; and 8 per cent believe that it is unnecessary.
4. With few exceptions the activities pursued in youth are the ones used most frequently in adulthood.
5. Individual activities and recreative games predominate in the selections named.

That exercise is most serviceable for adults that uses the large muscles of the body in forms of activity which are pleasant, enjoyable, producing satisfaction, and that lead

[1] Scott, H. A.: Recreation for business men. *The Nation's Health*, June, 1927, p. 39.

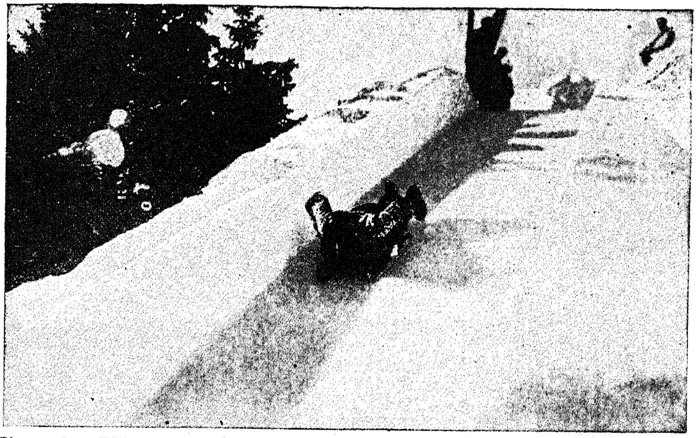

Fig. 58.—Winter sports are becoming increasingly popular today. (Courtesy of Riebicke, Berlin, Germany.)

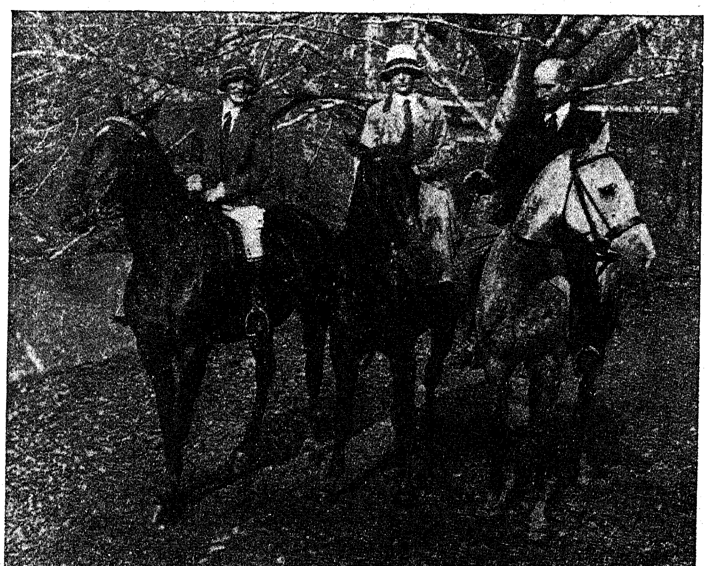

Fig. 59.—Horseback riding is not possible for many persons but it represents the quality desired in sport activities—pleasure and satisfaction. (Pacific & Atlantic.)

to habits of exercise. The most favorable forms to secure this state of affairs are swimming, hiking, camping with its varied activities, golf, tennis, skating, and coasting (Fig. 58). To these should be added horseback riding (Fig. 59), hunting, fishing, and gardening.

After thirty years of age the adult may engage in activities requiring moderate endurance; he is less well adapted for speed effort. He is beginning to lose his elasticity and should never be tested in severe competition, although golf, swimming, hiking, and skating may be pursued to their limits.

The perils of middle age are a gradual deterioration of muscle power with sagging of structures, notably the abdominal organs, that gradually lose their ability to function properly. These perils are to be overcome by daily physical activity. There is no short cut; no easy way out.

Adaptation to Sex.—There should not be any marked distinction in the type of exercise of the boy and girl up to and including the eleventh year. After that the change made should be in line with the teaching of biology as regards the difference in the sex characters and physical make-up dependent upon those characters. At one time the girl was regarded as a being unsuited for play and physical activity. The Victorian period of English literature shows us a girl who was interested chiefly in being unwell and ministered to as a weak sister. In America this type of girl is occasionally seen, but there is a healthy indication of more interest on the part of the girl and her parents in securing a vigorous foundation for the girl as well as the boy. It should be kept clearly in mind that both the girl and the boy are dependent equally upon the muscular system for the proper development and functioning of the vital organs of life. In both, the heart, the lungs, the digestive organs, and the nervous system must all rely upon the activity of the muscular system for efficient functioning.

The boy and girl both need vigorous exercise, but there are some fundamental differences between the body of the boy and that of the girl which determine the kind and extent of the activity to be followed. In the first place, the skeletal framework of the girl presents some important dif-

ferences. The bones are lighter. The pelvis is much broader, which gives to the thigh bones a marked obliquity. The width of the pelvis interferes with the running ability of the girl; in all movements of the lower extremities, either in walking or running, there is a lateral sway of the pelvis; and the extent of this oscillation determines the speed of the individual in getting over the ground. Because of this one factor of body construction the girl is unable to run as fast or as far as the boy. It is this sort of biological evidence that one must understand and respect, because one will not approve for the girl the kind of tasks held up to the boy. There are some people who feel that the girl should attempt to do the same physical feats of which the boy is capable. Such theory is distinctly contrary to the teaching of nature, and if one desires to progress one must remember to act in harmony with nature's laws and not contrary to them. It should be stated, therefore, that it is important to develop standards of performance of the girl that will be her standards. Girls should not seek to do the events in which the boys excel because they are boys' events, but rather they should try to excel in performances belonging peculiarly to women. There is no feeling here that girls are inferior to boys; it is meant that girls are different. There is need to provide for girls types of activity that are suited to their needs, on the one hand, and in harmony with their powers on the other.

It is common practice for girls and women to omit exercise during menstruation. In recent years this practice has been undergoing modification. Many physicians assert that the girl or woman should continue during the period the same wholesome practices in which they engage between periods. Runge[1] in a study of 100 girls engaged in gymnastic training in Germany found that in most cases gymnastics and sports exert a favorable influence upon the menstrual function. He concludes that it is not necessary to prohibit bodily exercise during this period. In cases of irregular menses or in married women with histories of previous preg-

[1] Runge, H.: Menstruation and Bodily Exercise. *Deutsche medizinische Wochenschrift*, December 7, 1928.

nancies or abortions, then permission for physical exercise during menstruation should be given only after a gynecological examination.

The following activities[1] are classified for mature and immature girls:

For Mature Girls.

1. Condemned:
   - Broad jump.
   - High jump (in competition).
   - Pole vaulting.
2. Doubtful:
   - High jump.
   - Running more than 100 yards in competition.
   - Weight throwing.
3. Safe:
   - Archery.
   - Ball throwing.
   - Basketball (women's rules).
   - Climbing.
   - Coasting.
   - Dancing.
   - Field hockey.
   - Golf.
   - Horseback riding.
   - Indoor baseball.
   - Low hurdles (not in competition).
   - Paddling.
   - Rowing.
   - Running.
   - Skating.
   - Skiing.
   - Snowshoeing.
   - Soccer.
   - Swimming.
   - Tennis.
   - Walking.
4. Especially beneficial and suitable:
   - Dancing.
   - Paddling.
   - Rowing.
   - Running.
   - Swimming.
   - Walking.

For Immature Girls.

1. Condemned:
   - Pole vaulting.
   - Running more than 100 yards.
   - Weight throwing.
2. Doubtful:
   - Basketball.
3. Safe:
   - Archery.
   - Ball throwing.
   - Broad and high jump (not in competition).
   - Climbing.
   - Dancing.
   - Golf.
   - Hockey.
   - Horseback riding (cross saddle).
   - Low hurdles.
   - Paddling.
   - Rowing.
   - Running (not in intense competition).
   - Skating.
   - Soccer.
   - Swimming.
   - Tennis.
   - Walking.
4. Especially beneficial and suitable:
   - Climbing.
   - Dancing.
   - Jumping (in moderation).
   - Running (in moderation).
   - Skating.
   - Swimming.
   - Walking.

[1] From Healthful Schools, by Ayres, Williams and Wood, Houghton Mifflin Co., Boston, 1916.

5. Best loved, most commonly practiced, and with greatest primitive appeal: Dancing (greatest unanimity of opinion in this answer).

Adaptation to Occupation.—When it is recalled that exercise is of value because of its effects upon the vital processes of life, it will be clear that the exercise necessary for health will vary in accordance with the activity of the person. The ditch digger at the end of a day's work does not need activity that will strengthen his heart and induce perspiration. He may, however, need activity of a kind that will have an exhilarating effect upon his nervous system. The clerk in a store engaged in sitting behind a counter and selling buttons does require effective stimulation of the lungs, heart, and skeletal muscles, and especially out-of-doors. In thinking of the adaptation of exercise to occupation it is important to remember that health is something more than the ability to eat and sleep. Health of the muscles and heart is important, but health of the nervous system must not be neglected. Exercise that is distasteful or uninteresting is not only of small value, but it may be positively injurious. For students in college as well as pupils in school, for clerks in stores as well as workers in the factory, the selection of exercise must be made on a basis of the person's occupation, and thus supply the margin of activity necessary to keep the entire body healthy and strong, a ready and willing servant of the mind. What this margin shall be varies with the vocation. But for all there is a minimum which will provide for strength and vigor of the vital organs and will keep the muscles in sufficient tone and strength to secure pleasure and satisfaction from motor activity. The individual with weak and flabby muscles cannot *enjoy* physical activity. The importance of joy in physical activity cannot be overestimated.

Adaptation to Climate.—Climate rather naturally makes its own adaptation of the individual in the matter of exercise. Persons who live for any length of time in the tropics gradually develop a distaste for exertion of a physical kind.[1]

[1] Huntington, E.: Civilization and Climate, Yale University Press, 1915, Chap. III.

In northern climates there is quite naturally an inclination even in winter for vigorous outdoor life. Nature should be followed here. The winter time is the most important time to carry on outdoor activities. Vigorous walking, outdoor games, skating, coasting—these are the things to do. It is because of the limitations imposed by the weather that people live such unhygienic lives in the winter. For many it is a period of semihibernation. Because of this, and the resulting accumulation of waste materials, so many feel the need of a "tonic" in the spring. It is important to state here that the best tonic in the spring, especially after an inactive winter, is out-of-door exercise with a rather careful limitation of the diet. This point will be taken up later in more detail.

Adaptation to the Individual.—It may be stated that all persons without serious disease need the general effects of daily exercise. These may be secured by walking (not strolling aimlessly, but walking a distance of 2 miles in at least thirty minutes), hiking, swimming, playing games such as golf, tennis, baseball, handball, and other sports.

The cardiac patient may need restricted and graduated work; the tuberculous person may need absolute rest. Such cases need the care and advice that a skilled physician can give.

Vigorous exercise is very undesirable immediately after eating and a period of rest after meals is beneficial. Crandall[1] has shown that exercise depresses the gastric secretion during the period of activity. Exercise causes a redistribution of blood, a rise in temperature, and a change in blood constituents. From his experiments, he concludes that heavy exercise interferes with digestion and that rest after meals is beneficial.

For some persons light exercise before retiring promotes sleep and for most people exercise in the open air to the point of fatigue, favors sound sleep.

It is in general inadvisable for any youth with any degree of rheumatic valvular heart disease to engage in the ex-

[1] Crandall, L. A.: The Effects of Physical Exercise on the Gastric Secretion. *American Journal of Physiology*, February, 1928.

treme exertion incident to the more strenuous sports, such as football, basketball, and hockey. The less strenuous sports, such as baseball, tennis, and golf, may be permitted when the heart disease is only slight or moderate. Exercise in moderation is more likely to be helpful than harmful. If the valvular disease is extreme, only the mildest exercise, such as walking, should be allowed. In general the above rules are safe to follow, but there are always exceptions and each case must be judged on its merits because of the complexity of the factors involved, such as rapidity of growth, general health, temperament, familial health and longevity.

Relative Value of Different Activities.—Not all exercise is wholesome. Some varieties are more desirable than others. The advocates of certain "systems" propose that it is only necessary to follow their method to secure health and happiness, if not life eternal itself. The virtue of their systems is likely to be greater the more they satisfy the needs of man as revealed by man's nature and development. On the contrary, many claim virtue because of certain "special" exercises which the founders "discovered." A consideration of the relative value of types is therefore important.

Play, Games, Sports, and Athletics.—Play forms seen in games, athletics, and aquatic and land sports afford the best type of exercise. They are the best for man because they are identical with or similar to the forms used by man in evolving from lower forms to his present position in the biological scale. Man's body works best when exercised in movements very like the movements that produced his body. These activities as types, contrasted with calisthenics, are so much more satisfying because of the interest and mental exhilaration that come in play forms.

Dance.—Folk and modern dance are excellent forms of exercise. Women are finding great satisfaction also in certain rhythmic forms that have advanced beyond the old esthetic technic.

Social dancing is wholesome exercise, natural in the form of movement, and physiologically valuable exercise if practiced in a sanitary environment. Unfortunately, the late

hours, the bad ventilation that so often accompany the social dance introduce factors that need to be controlled.

From another standpoint the modern social dance is open to serious criticism because it is frequently licentious, and often immoral, and tends by its indirect influences to a lowering of standards and to a debasing of fine human relationships. The social dance involves fundamentally the romantic position; it is often erotic in character. Hence it should be controlled by the finest and most accepted standards that will help boys and girls to fine forms of expression. It should be remembered that the standards of the social dance reflect the prevailing social and moral standards of society.

The young man or young woman who is interested in living most and in serving best ought to be concerned not only with the possession of splendid purpose but also in the expression of the finest and best in personality. It is not possible to "jazz" through an evening, cheek to cheek, body close to body, without arousing emotions and impulses that are biological, natural and worthwhile, but emotions and impulses so strong and impelling that they lead frequently to undesirable, unsocial, and immoral forms of expression. The problem is to be met, not by prohibiting the social dance, but by helping young people to acquire fine forms of dance.

Formal Gymnastics and Calisthenics.—Exercises of this type are less valuable than games, sports, and athletics. They are useful in special cases to correct special defects. Their application to life is so limited that lengthy discussion is unnecessary.

Setting-up Drill.—It ought to be possible for all persons to live in such a way that the activities of work or the activities of play provided all that was essential in physiologic results to keep the muscles in tone, the heart strong, and the different organic systems in good condition. There is here, as elsewhere in human life, considerable difference between the *ought* and the *is*. We are confronted with the fact that a very large number of people, especially professional and business men and women, follow pursuits that are strictly sedentary, and not conducive, under present

social organization, to adequate participation in motor recreation. Most of these could secure regular outdoor exercise each day by walking part of the way to or from work. For various reasons many seem unable to get exercise in a natural way. For these persons a setting-up drill taken every morning before the bath may be of real value in assisting to maintain the body in good physical condition. The following description of the exercises appeared first in the Teachers College Record which has kindly given permission to reproduce in part the author's original article:

In presenting a series of setting-up exercises it is important to emphasize certain limitations. It does not represent a complete system of physical education, nor may it be considered in all cases to provide everything that is necessary to maintain health. At best it is only a substitute for more wholesome exercise out-of-doors in the form of games and recreative sports. The following points, therefore, should be noted:

1. There is no short cut, no royal road, no easy way to health. The development and preservation of physical vigor require intelligent care of the body and scrupulous regard for the laws of health. One cannot with safety and assurance contract a few muscles, breathe deeply a few times, and obtain organic strength. In addition to exercise other factors must be considered, such as a healthful attitude of mind, the choice of proper recreation, the intelligent selection of food, the adjustment of work and play, and the care of the body functions. All are as important as exercise. It ought to be unnecessary to say that one cannot misuse the mind and body, and then breathe a few times, take a pill, and remain vigorous.

2. Health exercises as a rule have been devised to produce effects which could be felt by the person taking them. The idea that an exercise must be *felt* in order to be valuable is similar to the idea that medicine must have a nasty taste and a mysterious color in order to be potent. On the contrary, the most desirable sort of physical training will not produce soreness and will in no way strain the muscles.

3. Exercises usually offered to the public are based upon the artificial and unnatural movements of the Swedish or German systems. It should be appreciated more generally that the movements which man has made in developing from the lower forms of life into the human being that he now is are more suited to his needs than movements which are wholly unrelated to his phylogenetic inheritance.

4. Many of the exercises often proposed are distinctly harmful. For example, the human being should not bend the trunk backward (except in corrective gymnastics where the support is controlled), and breathing exercises which have no relation to physiologic needs of the body are often injurious.

The exercises that follow are natural movements; hence they are offered with the belief that they will be of some value to the sedentary worker in school or office. They will serve to provide some activity of a *natural* kind, and should be supplemented with as much whole-

some out-of-door exercise as is necessary to provide that "margin of motor activity" essential to individual health.

They do not represent a complete system of body building. They are not devised to meet the play requirements of children nor the recreative needs of adults. They will set up the body, but they will not restore a damaged heart, nor bring strength to a paralyzed muscle. They will help, however, in securing good posture; but they will not cure a crooked back nor remove fat from the abdomen and deposit it on the shoulders.

At times persons use morning exercises to stimulate a tired body. This is unwise. Rest and sleep are indicated for fatigue. If exercises are used in the morning on arising, they should be started easily and no effort made to reach suddenly a high energy output.

These exercises may be performed on arising in the morning and should be followed by the morning bath. They are devised to produce wholesome effects upon circulation and respiration, and they will aid digestion and elimination. Since they are devised to secure an uplift of the body in all the movements, the accent should be upward. In addition, the trunk muscles are vigorously worked and the correct use of the foot is favored.

The necessity of supplementing these movements with out-of-door exercises must again be emphasized. Such activities as walking, hiking, tennis, swimming, coasting, skating, horseback riding, canoeing, golf, dancing, athletic sports and games are suggested, but the extent of participation in them must be determined by the needs, capacities, and limitations of the individual.

The following description should be carefully noted and the pictures studied in learning the exercises.

Standing (Fig. 60)

The standing exercise (Fig. 60) is used to help in achieving a good standing posture. Much of the posture work in the schools is bad on account of the rigid and unnatural position attained. The body is too frequently put into such a posture that the relation of parts prevents quick and controlled action. One should seek to attain in standing an erect position without rigidity, thus insuring healthful functioning of abdominal organs, proper use of joints, and efficient use of the musculature of the body.

Exercise:

Stand with the feet parallel to each other and 6 to 8 inches apart. Place one foot (either one) 3 to 4 inches in front of the other. Have weight on both feet disposed to their outer edges. This position of the feet produces balance, pivot, and control. Push the trunk upward and lift the abdominal wall upward. Retain a feeling of relaxation in the shoulders, but secure a sensation of extension and lengthening of the body without contracting or tensing the muscles (Fig. 60).

Stretching (Figs. 60 and 61)

This is a natural movement that straightens the spine, lifts the chest, and overcomes the sagging of the abdominal muscles so commonly seen in adults.

EXERCISE:

On the command *One!* push the arms easily upward and rise on the toes as far as possible. Reach up as far as possible as if trying to get an object from a high place (Fig. 61).

On *Two!* let the arms sink and the heels touch the floor, but retain as long as possible the sensation of extension (Fig. 60). Do not let the body droop. The development of the proper muscle sensation is important.

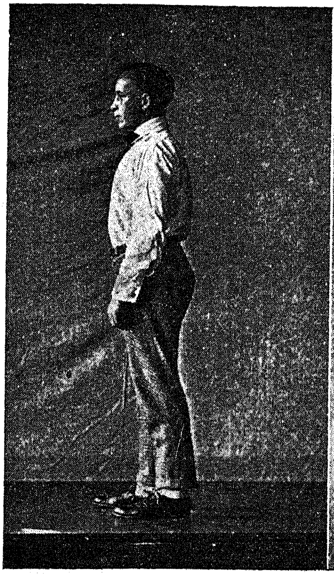

Fig. 60.

Fig. 61.

THROWING (Figs. 62 and 63)

This is a natural movement used by man in throwing a ball at an object. In learning movements that involve complex coordinations, do not think of the "end" of the movement, but keep clearly in mind the "means" to that end. Follow closely the directions for arm, leg, and trunk movement, and the coordination will come.

This movement is a powerful trunk exercise. It uses the back and side muscles and brings into play the large muscles of both arms and both legs.

The first part of the movement (Fig. 62) corresponds to the second part (Fig. 63) in position of trunk and legs. If the arms in Fig. 62 were placed in the position shown in Fig. 63, the similarity in the two parts of the movement would be instantly apparent.

Exercise:

Stand with feet about 24 inches apart and with the left foot about 6 inches in front of the right. On *One!* clasp hands lightly, waist high as shown in Fig. 62, shift weight to the right foot, bend the right knee, draw both hands to the right, twist the trunk to the right, and turn the head to the right. The left leg is straight and relaxed and the left heel is off the floor. The trunk is inclined forward (Fig. 62).

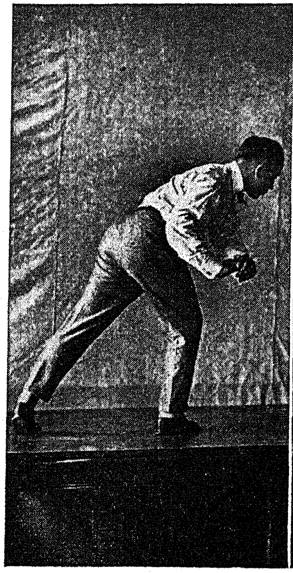

Fig. 62.

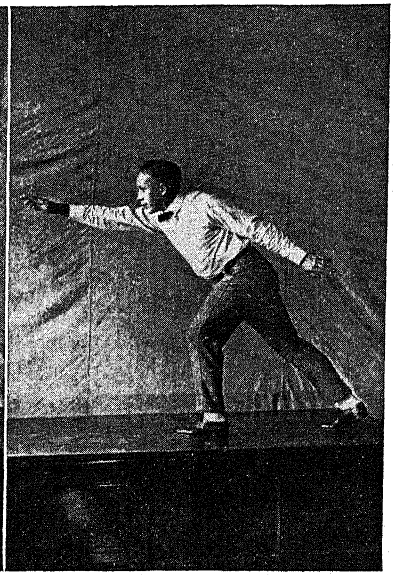

Fig. 63.

On *Two!* throw with the right hand, twisting the trunk sharply to the left. The left knee is bent and the right knee is straight with the heel off the floor. Notice that the body forms a straight line from head to right heel (Fig. 63). The weight has been transferred to the left leg. The right arm is forward and the left arm back (Fig. 63). The force of the throw turns the body in Fig. 63 a greater distance than in Fig. 62, and so the left foot is turned in the direction of the throw.

Lifting (Figs. 64, 65, and 66)

This is a natural movement used in lifting an object from one side of the body to the other, or from a low level to a higher one. It is an exercise of the back and legs and may be made very vigorous by reaching low and lifting high.

The movement as given has two phases: low lifting and high lifting.

EXERCISE OF LOW LIFTING:

On command *One!* bend the right knee and reach with arms to the right of the right foot about 12 inches from the floor (Fig. 64). The left leg is straight, the back is flat, and the movement occurs in the hip and knee joints. On *Two!* transfer the weight to the left foot and lift the object secured in command *One!* to the left and into the same relative position as in Fig. 64. Then the left knee will be bent, the right leg straight, and the arms will be to the left of the left foot about 12 inches from the floor.

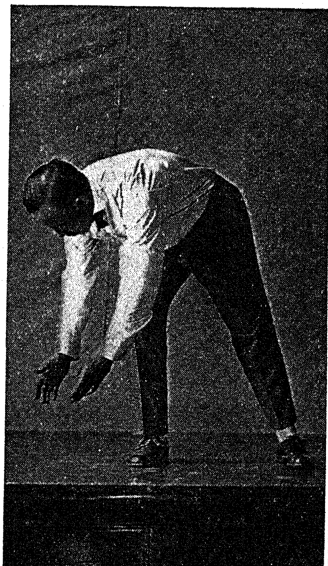

Fig. 64.

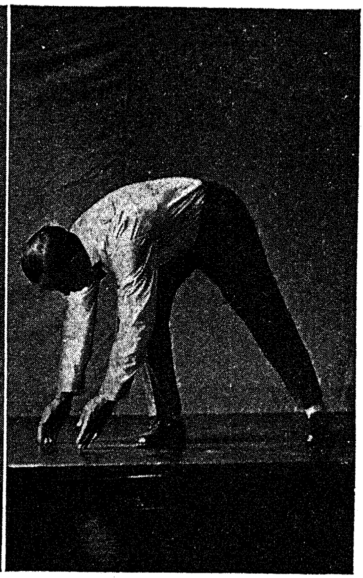

Fig. 65.

EXERCISE OF HIGH LIFTING:

On *One!* assume the position as shown in Fig. 65. The hands reach the floor and there is greater bending in the right knee and hip joints. The back remains flat and the left leg is essentially in the same position as shown in Fig. 64.

On *Two!* lift the object to the left and place it high above the head (Fig. 66). Vigorous muscular extension should occur in this part of the movement while the weight is being shifted to the left foot and the right leg is relaxed with the right heel off the ground.

CLIMBING (Figs. 60 and 67)

Climbing has always played a prominent part in the history of man. Our arboreal ancestors excelled in it and our children today at an early age seek to recapitulate their racial history in the same action. This movement is a powerful exercise for the legs and secures strong contraction of the abdominal muscles. As shown in Fig. 67, it represents reaching upward and grasping an object, as a limb of a tree or ladder rung and pulling up one leg to obtain support preparatory to pushing up the body. The arm movement is identical with the stretching exercise.

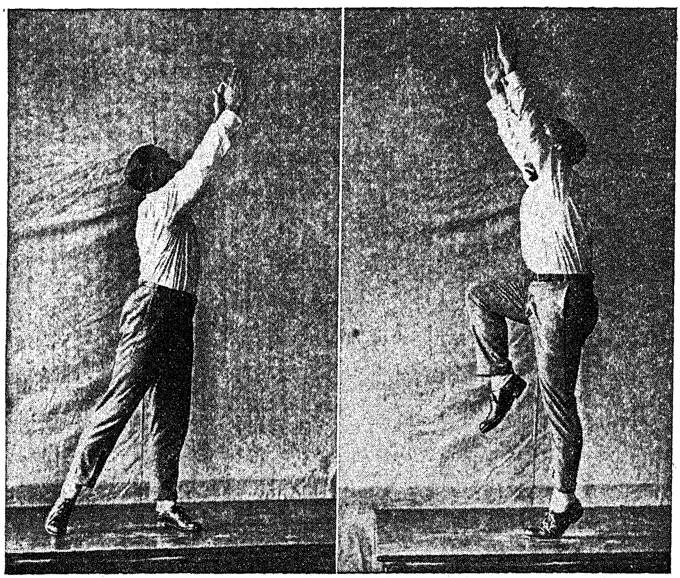

Fig. 66. Fig. 67.

EXERCISE:

On *One!* reach upward with the arms, raise the right knee forward and push the body upward on the ball of the left foot. Secure vigorous stretching upward. This is to be the accented part of the movement (Fig. 67). On *Two!* return to standing position (Fig. 60).

WALKING (Figs. 60 and 68)

The walking movement represents a natural exercise performed with movement of the opposite arm and leg. The act should be executed with the feet parallel and with the weight on their outer

edges. The illustration (Fig. 68) exaggerates the natural movement in some of its phases, but should be practiced as shown (Fig. 68) to secure the freedom in walking that is desired. Walking can be something more than a means of progression. Smooth arm movement and vigorous leg action will bring exhilaration into an act that is frequently rendered difficult by improper habits and clothing.

EXERCISE:

On *One!* raise the left knee forward and swing the right arm forward. The body remains poised on the ball of the right foot (Fig. 68). On *Two!* reverse the position of arms and legs.

Fig. 68.

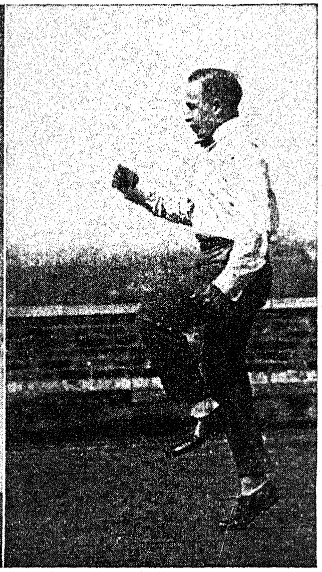

Fig. 69.

RUNNING (Figs. 60 and 69)

This is a natural exercise performed on the balls of the feet with vigorous thrusting upward of the knees and free and vigorous swinging of the arms (Fig. 69). It will be noticed that the right arm is forward when the left knee is forward. This opposition in walking and running is a fundamental compensation in the movement of the body to secure proper balance, direction, and control. This exercise vigorously stimulates the circulatory and respiratory systems, and will aid in improving all the functions of the organs supplying the body with energy. It should be possible for one to run and enjoy the movement (Fig. 69).

EXERCISE:

On *One!* swing the right arm forward and thrust the left knee upward and forward at the same time pushing the body upward on the ball of the right foot.

On *Two!* reverse the position of the arms and legs and push the body up on the ball of the left foot.

JUMPING (Figs. 70 and 71)

To clear an obstacle or grasp an object above one's standing reach one resorts to jumping. This is therefore a natural movement and it should be performed naturally. The first part of the movement

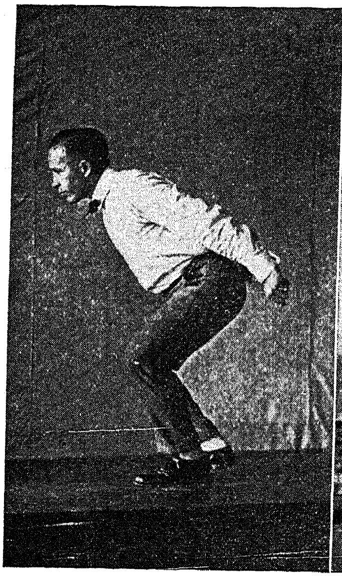

Fig. 70.

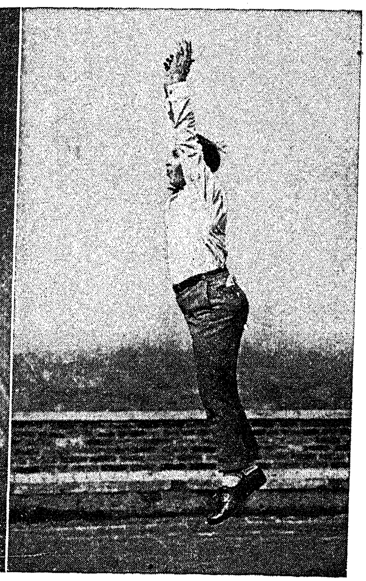

Fig. 71.

(Fig. 70) uses the muscles of the entire body, and in the second part (Fig. 71) the body is thrown into the air by the vigorous contraction of leg, back, and arm muscles. In the continuous jump the landing position, shown in Fig. 70, serves as the start for the next jump. At first the movement should be practiced without the jump.

EXERCISE:

On *One!* bend the knee and hip joints and incline the body forward (Fig. 70). Swing the arms downward and backward elevating the heels slightly. Note that the trunk is inclined and not held in

the upright and unnatural position sought in some gymnastic systems. On *Two!* swing arms forward and upward, and spring into the air (Fig. 71). The landing follows as a result of the movement and should assume the position shown in Fig. 70.

Habits of Exercise.—It is well known that one cannot build up in school days a store of health that will last for the rest of life. The star football player in college deteriorates rapidly after school days unless he continues his physical activity in some form.

Fig. 72.—Folk dancing is more common among European peoples than in America. The above shows some German youths dancing. (Courtesy of J. Gross, Berlin, Germany.)

College men and women ought to develop during school days a skill in and love for some sport, game, or physical activity which they will follow after school days are over. Activities lending themselves to such habituation are swimming, tennis, handball, and walking. To enjoy a "hike," to get out in the open spaces, to hunt, to fish, to ride horseback, to dance (Fig. 72), to row a boat, to chop wood, to play golf, to grow things in the garden are health-producing activities. Habituation to physical activity is one of the

goals that should be set not only for every college man and woman, but for all persons in the formative periods of school life.

All the Factors in Health Important.—In any health-building program care must be taken not to attribute to exercise more than belongs to it. In focusing an exercise there is a danger of neglecting other important health measures without which the greatest health cannot be attained. There are many individuals who live physically active lives, but who are lacking in vitality and vigor.

Other important considerations in a health-building program are care of the body as regards bathing, eating, sleeping, eliminating, dressing, and forms of recreation. There must be also appreciated in this connection the influence of mental states on physical health. Without stating at this time the psychology of related mental and physical states it should be noted that mental reactions to situations are important modifiers of organic processes.

We need, therefore, in the statement of the health needs of the individual something more than playgrounds, gymnasia, and athletic fields. We need these certainly, but in cooperation with these we need more hygiene in the schools, better sanitation in the schools, more opportunity for wholesome recreation for adults, and less transmission of communicable diseases;[1] we need instruction in the schools that will not only enable the child to develop into an industrially or professionally intelligent man or woman but also a chance for that child to develop the characteristics that will make him or her a good parent. It is coming to be appreciated that home economics may be very valuable for the training of the girl; it is to be recognized that certain phases of the conduct and organization of the home may very well be given to boys. Both boys and girls need instruction in the home training and care of children. It is rather interesting that babies have been born into civilized homes for many years, and in that time a certain body of information has been developed with reference to the training of children. Never-

[1] Annual Report of the United States Interdepartmental Social Hygiene Board. June 30, 1921, Washington, D. C.

theless, we allow young people to be educated in the schools and marry and bear children without giving them any scientific knowledge that would enable them to do the best that was possible for them to do. Of course, innumerable clinics are provided in the large cities for the curing of infants after they have a disease, but the intelligent and wise thing to do would be to instruct prospective parents at a time when they could be taught with some chance of preventing and correcting the intolerable conditions that at present prevail in the care and training of children.

A broad view of the health of the individual will include much more than exercise in a program that aims to achieve fineness in living and in service. A limited view may produce queer conflicts in which members of an athletic club will go to the gymnasium to engage in exercises ostensibly for the purpose of health, and will go out from the place and violate all the laws of health. There is need for an understanding of all the factors that enter into the production of health, and such conviction concerning human duty that the knowledge will be translated into effective action.

HYGIENE OF THE SKELETON

The Matter of Posture.—The bones of the skeleton are for the purpose of protection to certain parts of the body, for points of attachment for muscles, and for support to organs and structures. In order that the child may develop in the proper way it is necessary that the bones of the skeleton retain the shape and position in the body which will enable them to perform these functions. There is great importance, therefore, in the maintenance of the bony parts of the body in the correct position. This is of immense significance especially in childhood because the period of childhood determines the shape and position of the body in adult life. Correct postures modify body movement and condition the development of the vital organs, so that they should be sought at all times. It is very much worthwhile to acquire correct motor habits, on the one hand, and strong organs on the other.

The correct upright position of the body does not call for

an erectness that is sometimes asked for in gymnastics. It calls for an erectness in which the general line of the body is straight, the head poised on top of the chest, and not projecting forth at an angle like a gargoyle on the cathedral Notre Dame, the abdomen flat and contracted, and the weight placed so that the body can be moved readily in any direction.

Fig. 73.—The Victory of Samothrace: The reason for the excellence of the posture is found in part in the thought expressed by the body. (Pyle's "Personal Hygiene.")

Correct postures of the body *cannot be defined* adequately. A definition is incapable of expressing all that must be sought in the body from head to foot, but one can acquire appreciation of what is desirable by being guided by the best in living and art forms that express in good postures, elevated, optimistic, and happy states of mind. Such a form as the Winged Victory shows good posture (Fig. 73).

The reason for its excellence lies in the thought back of the motor expression.

Postures are expressions of mental and physical states: also, postures may modify and control mental states. It is possible by assuming an erect posture, by giving an appear-

Fig. 74.—The body should be balanced. (Pyle's "Personal Hygiene.")

ance and expression of joyfulness, cheer and optimism, to replace a depressing mood with the opposite. The cultivation of a happy, cheerful, optimistic nature more readily achieves results when efforts are also made to walk with an elastic, springy step, to hold the head erect and the abdomen

flat. Balance is an essential in proper use of the body (Fig. 74).

Individuals taking too little exercise are frequently equipped with such weak muscles that it is impossible for the parts of the body to be held in their proper position. Too frequently college girls and other young women who have neglected their body building activities present bodies so miserably weak that the effort to stand erect is muscularly so fatiguing that the upright position is never held in an habitual way. These weak women try to cover their infirm and ineffective bodies by masking it behind a pose or a slouch that may happen at the time to be in style; but only the thoughtless are fooled. Such posture is essentially the posture of a frail body. It represents a body that is unable to do the work and meet the responsibilities that come with adult life, with marriage, and motherhood. Such girls, instead of possessing an attraction, unfortunately own a body that is relatively less able to express and share happiness, to work and achieve results, to serve and receive service.

Value of Good Postures.—Although it is exceedingly difficult to define good postures, it is not at all difficult to realize the advantage of postures in which the parts of the body at mechanical advantage and the body as a whole are responsive to the needs of the environment. The values flowing from such postures are several:

1. *Hygienic value:* The erect, straight, vibrant body has its organs properly suspended so that bodily functions are more complete and perfect.
2. *Economic value:* Good postures pay. They speak of the spirit within the body. The young man or woman seeking a business position portrays his or her mental energy and alertness by the way he or she stands and walks.
3. *Social value:* Despite the influence of pernicious and silly styles, it may be said that personal attractiveness is more properly measured by a splendid carriage of the body rather than by a "debutante slouch."

4. *Spiritual value:* The spirit is uplifted with a physical uplift of the trunk. The glory of the rising sun is never seen by one walking with protruding head and abdomen and flatfeet.

Four Important Positions.—There are four positions of the body that are important because of their influence on health and happiness. Sitting, lying, standing, and walking are such common postures that they influence greatly bodily activity. If correctly performed, the influence is good; if done badly, the result is inefficiency and frequently ill health. The description of these four should not be taken to mean that other postures are unimportant.

We sit more than our ancestors did. Much sitting has caused weakness of trunk muscles, and much bad sitting has resulted in abnormalities of the trunk itself. One should sit in a chair so that the trunk is straight. Bending the body forward should occur at the hip joint. To prevent bad trunk position it is helpful to sit far back in the chair. Chairs that are too high or too deep prevent proper sitting.

In reclining, relaxation of all muscles should occur. Complete relaxation is not possible in lying on the back. It is generally agreed that lying on the right side[1] (or partially on the face) is more desirable than lying on the back, because it favors muscular relaxation and makes less pressure on the heart.

Standing is very tiresome and fatigues one more than walking. This is due to the slowing of the circulation in the legs. This fatigue cannot be overcome except by activity, but it can be lessened by a posture which facilitates the blood flow. The body should be balanced on the balls of the feet with the weight on the outer side (Fig. 74). Keeping the weight poised and the abdominal muscles flat will assist the return of venous blood as well as contribute markedly to general well being.

It has been said that walking is a lost art. It is true that people walk less frequently today than formerly, but the

[1] Other factors such as lighting, ventilation, or noise, may more readily determine whether the sleeping position shall be right or left side. Other things being equal, the right side is preferable.

growing interest in walking is a most hopeful sign for health. In walking the weight should be carried on the outer side of the feet, and the feet should be used in a parallel position so that the toe will point directly forward. Toeing out and throwing the weight on the inner side of the foot are productive of arch trouble.

But in addition to these mechanical points in walking it is important to note that the way we walk depends very largely upon the way we think and feel. That drab seriousness that clothes so many of us with its colorless mantle affects even our walk. Cabot,[1] with wonderful spirit, writes:

> What is this melancholy and crestfallen line of persons, whom I see moving along Beacon Street or Commonwealth Avenue toward the heart of the city, a little before 9, in the crisp and frosty morning. So mechanical and spiritless is their gait as they plod along that one might fancy them members of the sad, exploited proletariat, crushed by overwork, exhausted by want of sleep. In fact, they are prosperous bankers and lawyers on their way to business, and the only trouble with them is that they have just lapsed into being serious and serious only. It has never occurred to them that walking could be anything better than a means of sober progression. Poetry in walking? Don't suggest that to practical men. They'll think you a dangerous character.

Prevention of Common Skeletal Deformities.—The skeleton may develop deformities due to improper posture, lack of sufficient food of the proper kind, unusual loads imposed upon the bony parts, either as severe strain in occupation or as increased weight, sequels of disease, or the actual process of a destructive disease itself. The common deformities relate to the spine and to the feet.

Curvature of the Spine.—There are two main types of abnormal curvature of the spine: one from front to back; the other from side to side. The former results in round shoulders (kyphosis) or hollow back (lordosis); the latter in lateral curvature (scoliosis) of a mild or severe grade.

Round shoulders and hollow back are largely the result of poor postures in work and play, incorrect adjustments of the parts of the body. They can be corrected by proper exercises and the will to overcome faulty habits.

[1] Cabot, R. C.: What Men Live By, Houghton Mifflin Co., Boston, 1914, p. 93.

Lateral curvature frequently follows infantile paralysis, and the mild cases of this disease probably provide a large number of the scolioses seen. Other causes which have been suggested are carrying of books on one arm, standing on one foot, and writing at a desk of improper height. Curvatures of a postural kind can readily be corrected by corrective gymnastics if the individual is interested to overcome the defect; those resulting from disease are more difficult to control.

Shoulder Braces.—Many parents are led to suppose that shoulder braces are effective means for correction of round shoulders. This is absolutely wrong. The wearing of braces is distinctly harmful in that they do the work that the back muscles should do, and hence allow these muscles to become still weaker and less effective agents of body control. In the growing period of childhood postural deformities more frequently occur. They should receive attention at that time. This should be in the form of corrective exercises prescribed by physician or corrective specialist who knows the problem. It is very important to select some one whose personality will arouse and hold the interest of the child in striving to overcome the defective condition.

Weak, Deformed, and Flatfeet.—The normal human foot is constructed of bones arranged in such fashion that a long arch is made on the inner aspect of the foot, and a transverse one in the region of the ball of the foot. These arches are sustained by ligaments of the foot and by muscles of the foot and leg. The entire mechanical structure of the foot indicates its use to be as follows:

1. The foot in action should be placed on the ground with the line of direction parallel to the line of movement. The toes should point forward then, and neither be turned outward nor inward.
2. The weight of the body should be carried forward from the heel to the ball of the foot with its disposition always to the outer part of the foot (Fig. 75).
3. In walking the heel should strike the ground first, and the weight then be transferred to the toes. Every

step should produce elevation of the body on the ball of the foot.

Causes of Foot Weakness and Deformity.—The cause of most foot troubles is improper shoes. Shoes too narrow, too short, of improper lines, with high heels, are especially condemned. Many young people permit the shoes salesman to make the foot fit the shoe. The principle to be applied is that the shoe must fit the foot.[1]

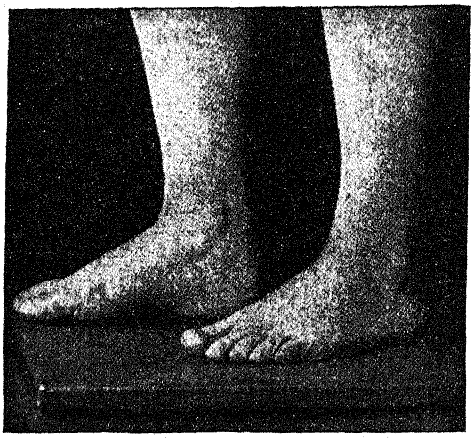

Fig. 75.—This photograph shows the feet of a college girl. Her feet have been unspoiled by improper shoes. Notice the arch in the right foot and the way the outer side of the left foot carries the weight. (From Williams, "Healthful Living." By permission of The Macmillan Co., Publishers.)

Points of a Good Shoe.—The style today may be high tops or low oxfords, ties or buttons, military heel, or the extreme French. These are incidental and meaningless for those who see straight and refuse to get their values mixed. The thoughtless, the careless, the vain will run after the baubles of style and be handicapped in action and in freedom

[1] Buka, A. J.: The Foot and the Shoe, *Journal American Medical Association,* August 10, 1929, p. 445.

of movement. Others, seeing real values, will look for the following in choosing a shoe:

1. An approximately straight inner line from heel to toe. Some feet show an inflare and some an outflare. There are shoes to fit these types. Most feet show a straight inner line and, as a rule, the straight line test for shoes should be applied.
2. Front part of the shoe should be as broad as the foot for which it is designed.
3. The heel should not be over $1\frac{1}{4}$ inches high and should be as broad on its wearing surface as the human heel.
4. The shoe should fit snugly around the arch and instep of the foot and loosely over the toes.
5. Patent leather shoes should not be chosen because they do not allow free ventilation of the feet.

Rubber heels are distinctly valuable for city wear. The human body developed its structure and functions with reference to an agricultural type of life. While adjustments may be going on in the body, fitting it to city conditions, such as hard floors and pavements, it is nevertheless good hygiene to use an appliance such as the rubber heel to relieve the body of jar as much as possible. The relief of fatigue and the increased sense of elasticity are values significant enough to warrant the use of rubber heels.

Flatfeet.—Many causes may contribute to produce flatfoot. This unfortunate condition should have the care of an expert in such matters. Modification in occupation, reduction of weight, change in manner of walking, use of orthopedic shoes, wearing for a time arch supports—all may be necessary to effect a cure.

Exercises for Weak or Fallen Arches.—If the long arch of the foot is weak, if pain is beginning, the following procedure is important.

1. Examine the shoe to see if it is at fault. If so, correct.
2. Note whether an increase in weight occurred. If so, reduce.
3. If occupation involves standing for long periods, try to

adjust by sitting at work and begin walking every day.

4. In walking note as follows:
   (*a*) Keep weight always on outer side of foot.
   (*b*) Keep feet parallel in walking. Do not turn feet outward.
   (*c*) Let the heel hit the ground first and then transfer the weight forward along the outer edge of foot to the ball.
   (*d*) Push off strongly with the toes and do not let the leg swing entirely from the hip.

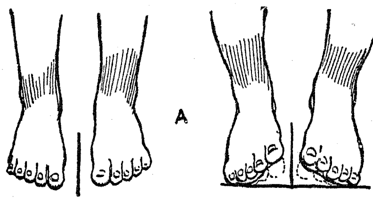

Fig. 76.—This shows the feet in two positions with the start and end of the foot roll. (Lewin, "Amer. Jour. Dis. of Children," May, 1926.)

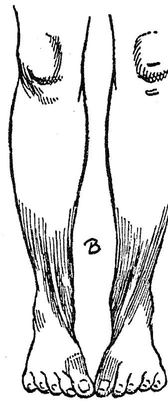

Fig. 77.—This shows the foot roll with big toes on the floor. (Lewin, "Amer. Jour. Dis. of Children," May, 1926.)

5. Practice twice daily the following exercises:
   (*a*) Stand barefooted with the feet parallel, and about 2 inches apart, straddling a seam or a line in a rug. On the count of 1 the feet are forcibly turned out, and on the count of 2, they are allowed to slowly roll in, but not all the way. This is carried out from twenty-five to one hundred times (Fig. 76).
   (*b*) Same as (*a*) except that the two big toes are held together and on the floor (Fig. 77).

(*c*) Stand with the feet straddling a seam in the rug or a line on the floor and walk across the room with all the weight borne by the outer borders of the feet. This is done five times up and back (Fig. 78, C).

(*d*) Same as (*c*) except that the feet are raised alternately opposite the other knee (Fig. 78, D).

If the arch condition is not corrected by the above procedure, see an orthopedic surgeon at once.

Disturbance in the arch in the front part of the foot requires a pad for support. This should be supplied by an orthopedic surgeon.

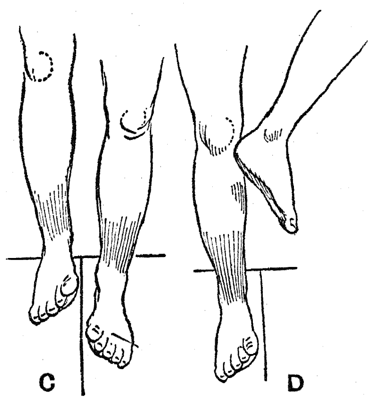

Fig. 78.—This shows the so-called "ostrich step." (Lewin, "Amer. Jour. Dis. of Children," May, 1926.)

Perils of Maturity.—The dangers to adult life associated with the muscular and skeletal systems are direct and indirect. The direct losses come from inability of the locomotor mechanism to execute the old skills, carry the former loads, and enjoy the favorite activities. These hazards may be prevented largely by avoidance of the sedentary life, through participation in games, sports, and out-of-door recreations of an active type. With advancing years the extent and intensity of physical activity must

decrease, but until incapacitated by controlling defects, the perils of sedentary life should be consistently fought.[1]

The indirect effects on the vital systems are to be noted. This relationship is so clear that even the merest tyro in hygiene must know its implications. Recent study of the occupational distribution of diabetes shows clearly one of the possible effects of sedentary life. It is with difficulty that man learns the secret of living well. Spending time and energy to gain a competency, seeking continually to escape the necessity for physical labor, he achieves leisure only to lose health. The problem of education is increasingly a problem of education for leisure, and in the category of things which are taught must be provided a large place for wholesome physical recreation.

The joints and ligaments of the body suffer from two deficiencies in mature years:

1. Increase in body weight without a corresponding increase in supporting strength.
2. Decrease in tone of the ligaments due to general loss in body tone accompanying the sedentary life.

These conditions are to be combated by keeping the weight at the desired average for the height, and by improvement of strength and tonicity of ligaments by exercise, outdoor air, rest, and recreation. To maintain the body at a level of efficiency that will make possible the best work and the largest happiness requires expenditure of time in care of the body and its use in motor activities. To give this time from vocation is often difficult; to achieve efficiency in any other way is impossible.

QUESTIONS AND EXERCISES

1. State the value of early and thorough development of the muscular system.
2. Cite evidence showing the relationships between mental and physical ability.

[1] For a discussion of the health care of the aged, infirm, and invalid see: Williams, J. F.: Hygiene and Sanitation, W. B. Saunders Co., Philadelphia, 1935. Chap. VII. With collateral readings on the topic, pp. 347–348.

3. List the habits of muscular activity characteristic of different stages of human development.
4. State the minimum essentials for physical development.
5. What is meant by rational exercise? Set up criteria for determining rational exercise.
6. State the beneficial effects of rational exercise.
7. List the injurious effects of sedentary life.
8. Discuss briefly the adaptation of exercise to age; to sex; to occupation; to climate; to the individual.
9. What types of activities are most suitable for a school program?
10. Sketch a program of activities for your grade for one week.
11. List high school activities which contribute to the recreational life of the adult.
12. In what situations is it useful to use formal activities?
13. Try the natural exercise drill given in the text. When should it be used?
14. State the importance of regular habits of exercise.
15. List important considerations in a health-building program other than exercise.
16. Describe the correct upright position of the body.
17. State briefly the values of good posture.
18. State causes of the common skeletal deformities.
19. Enumerate the points of a good shoe.
20. What perils related to the muscular and skeletal systems may confront persons of mature or old age? How may these conditions be combated?

CHAPTER VII

HYGIENE OF NUTRITION

I. Anatomical and Physiological Backgrounds:
   1. Food in the Mouth.
   2. The Factor That Causes Chemical Change.
   3. The Food is Swallowed.
   4. Food in the Stomach.
   5. Food in the Small Intestine.
   6. The Large Intestine.
   7. The Liver and Pancreas.

II. Sources of Energy.

III. Digestion, Assimilation, and Nutrition.

IV. Basal Metabolism.

V. Caloric Values of Different Articles of Food.

VI. Classification of Food:
   1. Food to Yield Energy.
   2. Food to Build Tissue.
   3. Composition of Vegetable and Animal Proteins.
   4. Food to Regulate Body Processes.

VII. How Vitamins Affect Nutrition and Growth.

VIII. Foods and Vitamins.

IX. Characteristics of the Different Vitamins.

X. Mineral Salts as a Dietary Essential.

XI. Composition of the Body in Terms of Its Elements.

XII. The Rôle of Mineral Salts in Food.

XIII. The Mineral Salts and Body Reaction.

XIV What Common Foods Give.

XV. The Hygiene of Nutrition:
   1. Wise Choice of Food.
   2. Correct Eating.
   3. Regular Evacuation.

XVI. Causes of Indigestion.

XVII. Fads and Fallacies in Diet:
   1. Vegetarianism.
   2. Hot Water Fad.
   3. Raw Food Fad.
   4. No-breakfast Fad.
   5. Sour Milk Fad.
   6. Dieting.

XVIII. Food Adulteration.

XIX. Alcohol:
   1. Alcohol and Length of Life.
   2. Alcohol and Efficiency.

XX. Coffee, Cocoa, Tea.

Anatomical and Physiological Backgrounds.—The alimentary canal traverses a distance of about $2\frac{1}{2}$ feet and yet it is about $26\frac{1}{2}$ feet in length. These measures vary with

size and sex of the individual. This enormously extended canal provides digestive areas and assimilative surfaces of considerable extent. Some notion of the anatomy and physiology involved may be secured by a portrayal of what happens to a morsel of food as it passes through this tube that is about 9 yards long.

Food in the Mouth.—The teeth, 32 in number, if all are present, serve the sole purpose of separating solid food masses into smaller bits. This process is called mastication. It is modified by the nature of the food and varies with the chewing habits of the person. While the chewing of the food is going on the tongue pushes unchewed portions between the teeth, and lips and cheeks cooperate in the process.

From six sources, the salivary glands, little squirts of saliva are ejected which mix with the food, soften it to some extent, and begin a minor digestive process. The six glands are the two parotid, two lingual, and two maxillary. The flow of their secretions is stimulated by a mechanical factor (food in the mouth) and by a psychic factor (thought, sight, or smell of food when hungry). Glands of the mucous membrane of the mouth add mucus to the mass. These juices from the salivary glands and mucous glands begin a series of chemical changes that will become more pronounced later.

The Factor That Causes Chemical Change.—Mastication is a physical alteration of form. Chemical change results in the formation of different chemical compounds. Some chemical change is produced by an acid, hydrochloric acid, in the stomach, but typically the change of food in digestion is the result of actions by enzymes.

Enzymes are chemical substances produced by cells; their chemical nature is unknown. They act by catalysis; that is they initiate change but do not themselves enter into the chemical reaction. They require a certain medium for action. An enzyme for an alkaline medium does not act in an acid one. They have the power to cause the change of complex molecules of protein, fat, and carbohydrate into simpler compounds. An illustration of this action in carbohydrate digestion follows:

$$\underset{\text{(Cane sugar)}}{C_{12}H_{22}O_{11}} + H_2O \longrightarrow \underset{\text{(glucose + fructose.)}}{C_6H_{12}O_6 + C_6H_{12}O_6}$$

The chemical process is more complicated for fat and protein. In the former case, an enzyme, lipase, splits fat into glycerol and fatty acids. The fatty acids are converted into their sodium salts (called soaps). In an alkaline medium of the intestine, the soaps form an emulsion which is rendered stable by the action of certain salts from the bile. This very brief description of an exceedingly complex process is given here, not to inform the reader regarding the process but to make clear the very complicated nature of this change.

In protein digestion, the process is even more complex. Food proteins are broken down into soluble and diffusible substances that can be assimilated by the cells.

The enzyme of the saliva is ptyalin which acts upon starch and starts a chemical change that may continue for some time in the stomach until the food acquires an acid state.

The Food Is Swallowed.—An observer of this series of physical and chemical changes of food in the mouth, would note that as a portion of food was chewed into small bits and mixed with saliva and mucus, a ball of the masticated material would be pushed by the tongue and a muscular action of the throat past two pillars of a gateway that opened into a rather capacious rotunda, the pharynx (Fig. 79). He would note also that without delay the bolus passed through this, avoiding cleverly a yawning cavern whose door closed at the right time. In less than the typical Jack Robinson time the bolus of food has entered a tube, the esophagus, and is now carried downward by a curious movement of its walls that keep pushing behind and opening in front.

The pillars of the gateway are two bands of tissue between which lie the tonsils when they are present. So well known, however, is the danger to health of infected tonsils that they are frequently absent in adults; their removal in childhood is an accepted and standard hygienic practice, if they are markedly enlarged or infected.

The gateway opens into the pharynx, an enlargement of the alimentary canal at this point. This capacious space is a sort of general terminal of several passages and tubes. In the upper part of the pharynx are the two openings from the nose and the two small apertures that mark the connection of pharynx and middle ear through the eustachian tubes. Below is the tube that leads to the lungs, via the larynx, trachea, and bronchi, and the tube into which the food has entered, the esophagus.

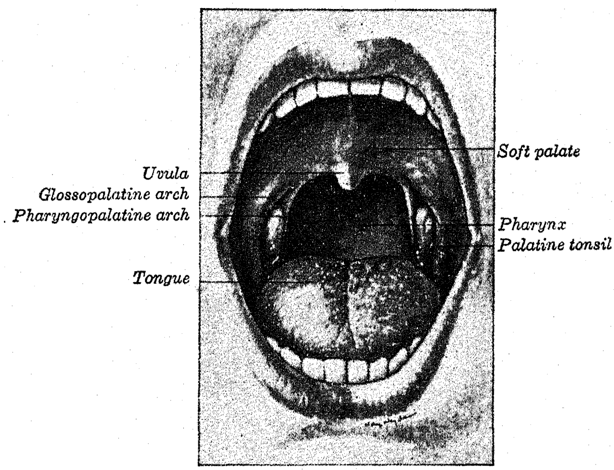

Fig. 79.—The mouth. (Callander.)

As food and drink pass to the esophagus, the larynx is closed in the act of swallowing by a lifting of the larynx up against the door that serves to block it (Fig. 80). When one breathes the passage remains open. When one tries to swallow and breathe at the same time, particles of food may be drawn into the larynx which results in a violent reflex of coughing to expel the invader.

Food in the Stomach.—Food does not drop into the stomach as stones into a well, but is carried there by the series of contractions in the esophagus already referred to. These

are called peristaltic waves. These waves or contractions (peristalsis) occur also in the stomach and intestine.

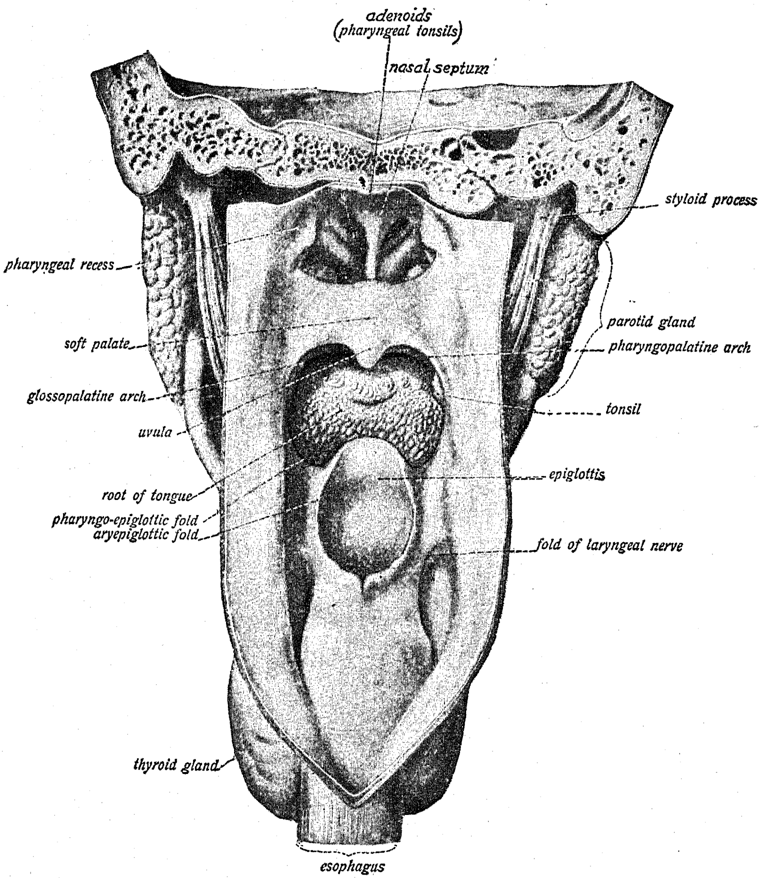

Fig. 80.—View of the pharynx from behind, its posterior wall being divided in the sagittal line. Horizontal incisions have also been made in its upper portion and its posterior and lateral walls reflected. (Sobotta and McMurrich.)

The wall of the stomach is composed of mucous membrane in which are many gastric glands, and muscular layers in the different coats that provide for peristalsis.

An observer of the food coming into the stomach would note that the notion of the stomach as an empty bag is quite erroneous, in fact that there seemed to be no space at all. As other portions of food arrive, however, the remarkable expansile properties of the organ for accommodating the arriving food would be revealed. It would be noted that at all times the food fills the stomach.

Furthermore, the food in the fundus remains quite undisturbed but as portions reach the other end, the pylorus, they

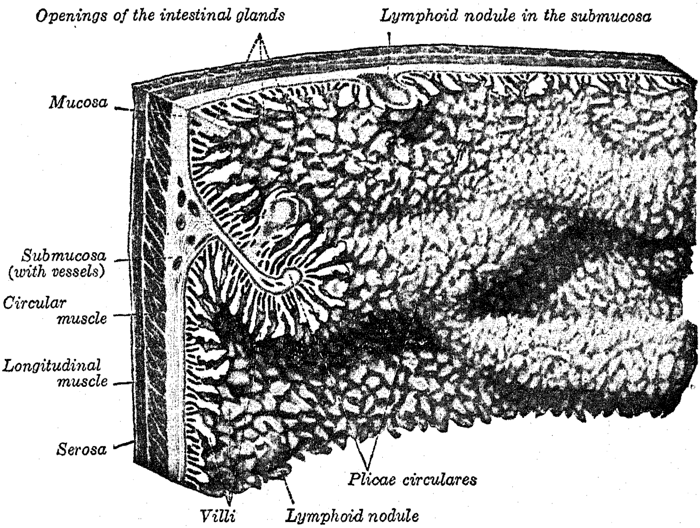

Fig. 81.—The wall of the small intestine. 17 ×. (After Braus.)

are subjected to an orderly series of contractions that carry partly digested material called chyme to the opening into the intestine.

During its stay in the stomach, the ptyalin acts upon starch as long as the food mass concerned remains alkaline. As the gastric secretion from the wall of the stomach penetrates the mass, this action ceases for the gastric juice is acid. There are three agents in this secretion: hydrochloric acid and pepsin, an enzyme, that act upon protein; and

rennin, an enzyme, that acts upon caseinogen, the protein of milk. It is believed that fat undergoes no digestive change in the stomach, although it is mechanically altered in the process.

Digested food and water are not absorbed from the stomach in marked quantities if at all. Alcohol is rapidly absorbed, however, in the stomach.

Food in the Small Intestine.—From time to time liquefied food is passed through the pylorus into the first part of the small intestine. Now begin a remarkable series of events. Waves of contraction (peristalsis) pass over the walls of the tube moving the contents along the canal. Chemical activity is marked. The digestive glands of the intestinal mucous membrane are supplemented by digestive juices poured into the tube from the pancreas and the liver. The membrane of the canal is constructed with innumerable finger-like processes, called "villi," that enormously increase the surface of the canal. Portions of the liquefied contents sift into the spaces between the villi and are brought into close contact with the openings of the intestinal glands. This arrangement also favors absorption (Fig. 81).

The intestinal juice contains several enzymes that digest carbohydrates and proteins. The pancreatic juice acts on fats, carbohydrates, and proteins. The bile from the liver is, in fact, not a digestive agent. It acts upon fats to emulsify and saponify them; digestion of the fat is then easily accomplished by the fat enzymes. The digestion process is finished by the time the food reaches the large intestine. All the changes that take place are not known but the main effects can be described. It results in the breaking down of food masses into liquefied form and the chemical change of the compounds of fat, carbohydrate, and protein into smaller units. These changes can be tabulated (Table III, page 217) as shown.

The Large Intestine.—After traversing some 20 feet of small intestine, the food that entered the mouth has become greatly changed. An observer of the change might well wonder at the process; the juices pouring into the canal, the ceaseless movement of the tube, the altered consistency of

TABLE III

Table of Digestion

In the mouth	Food and a psychic factor[1]	produce → *Saliva* which contains	Ptyalin[2] acting on starch + water = dextrin[3] + maltose[3] and Maltase[2]—acting on maltose + water = dextrose[4]
In the stomach	Food and a psychic factor[1]	produce → *Gastric juice* which contains	Pepsin[2] Hydrochloric acid } acting on protein + water = albumin[5] proteoses[5] peptones[5]; Rennin[2]—acting on caseinogen (milk) = casein.
In the intestine	Acid chyme from the stomach	Activates prosecretin in the cells of the wall of the first part of the intestine producing → *Secretin*	

Secretin passes in the blood to:

The liver and stimulates the flow of *bile* whose salts:
1. Aid in the emulsification of fat.

Intestinal glands and stimulates the flow of *intestinal juice* whose—
1. Erepsin[2] converts proteoses and peptones to amino-acids.[6]
2. Inverting enzymes convert the di-saccharides to monosaccharides.
3. Enterokinase with trypsinogen acts to form → Trypsin[2]

Pancreas and stimulates the flow of *pancreatic juice* whose—
1. Amylase[2] acts like ptyalin.
2. Steapsin[2] acts on fat.
3. Trypsinogen with enterokinase acts to form → Trypsin[2] which changes proteoses and peptones to amino-acids.[6]

[1] Psychic factor. Thoughts and emotions stimulate and inhibit the flow of digestive juices.
[2] An enzyme.
[3] Intermediate stages of carbohydrate digestion.
[4] Final form of carbohydrate digestion.
[5] Intermediate stages of protein digestion.
[6] Final stage of protein digestion.

the contents. If one in imagination were to travel over the remainder of the canal, the digestive process would yield little information. Water is lost and the liquid contents gradually acquire a semisolid consistency. Most interesting anatomical parts, however, would appear along the way. As

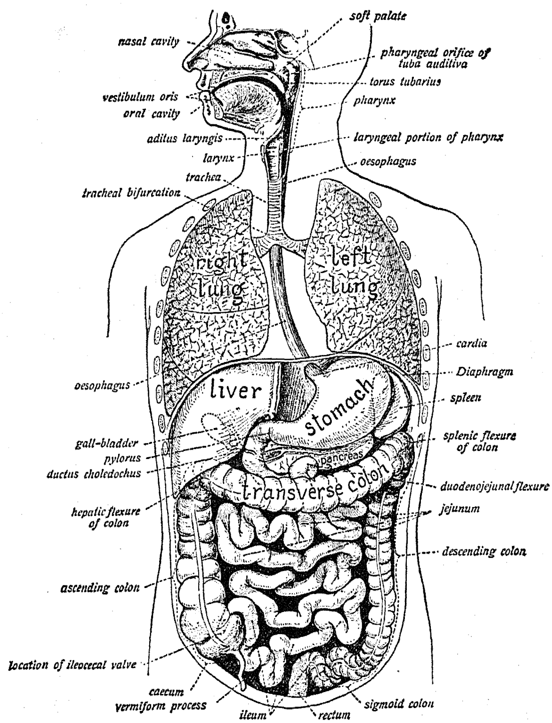

Fig. 82.—Diagram showing the arrangement of the digestive and respiratory organs. (Sobotta and McMurrich.)

one leaves the small intestine one enters a much more capacious canal and the first portion, the cecum, is a kind of blind pouch from whose bottom extends a wormlike appendage, the vermiform appendix. It has, however, a lumen so entrance is possible but the traveller, like any visitor to an

old medieval castle, would be reminded of far-off times. The appendix is a mute reminder of other days, a vestigial structure of ages long past, with no functional use in the economy of modern man.

With gradual absorption of water from the contents of the colon and the cessation of chemical action, bacterial life becomes more marked. The micro-organisms become mixed with chemicals of putrid odor, decomposing bits of undigested food, unabsorbed salts, fatty globules, and the varied remnants of the whole process. This motley assembly moves

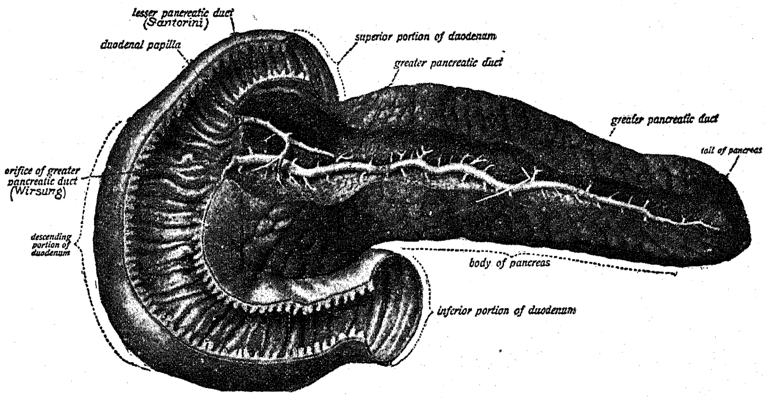

Fig. 83.—Pancreas and duodenum seen from in front. The pancreatic ducts have been exposed by dissection of the pancreas in front; the duodenum has been divided longitudinally. (Sobotta and McMurrich.)

through the ascending colon to the under surface of the liver; turns left across the abdomen, and then descends on the right side to the brim of the pelvis where it attains a central position ending in the rectum (Fig. 82).

The Liver and Pancreas.—Two glands outside the canal and yet emptying into it and hence associated with digestion are the liver and pancreas. The former is a mass of about 4½ pounds in a person weighing 160 pounds. The cells of the liver secrete a substance called "bile" that is collected by ducts into a tube that empties into the gallbladder.

This serves as a storage basin for the bile. During digestion the bladder empties into the upper portion of the small intestine by means of a duct.

The pancreas is a gland about 6 inches long and 2 inches wide. It has most interesting functions. It yields a digestive juice that flows from a duct to the small intestine and

Fig. 84.—Even the American Indian faced difficult problems in storing food. This picture is from an old drawing made in 1564. The storehouses shown are vastly different from grain elevators of today. (From Carrier, "Beginnings of Agriculture in America," McGraw-Hill Book Co., Inc.)

plays a large part in digestion (Fig. 83). In addition, certain cell groups of the pancreas yield a secretion that empties directly into the blood stream. This internal secretion is essential in the utilization of sugar by the muscles. When the secretion is absent or deficient, the individual is unable to burn sugar and becomes sick. The disease is called diabetes.

Sources of Energy.—The sources of human energy were discussed in Chapter IV. To find food that would provide human energy has always been an important problem to man (Fig. 84). It is recognized today that energy is dependent very largely upon food. Sherman[1] says: "The activities on which the life of the body depends involve a continuous expenditure of energy and the constant exchange of material." This continuous expenditure of energy is dependent upon food taken into the body, and this food serves not only to provide the known chemical compounds which directly release energy but also it provides substances serving to stimulate and promote growth and to regulate body processes. Health, as evidenced in activity or in growth of the body, is seen to be dependent upon not merely chemical compounds that will produce upon digestion so many heat units. Normal growth, normal work, and power of normal reproduction will be seen to be due to other substances in food that do not yield calories, but serve as regulators, organizers, and stimulators of bodily activity. The old emphasis upon the caloric yield has been broadened to include other important factors in determining man's dietary. The chief functions of food then are, as Sherman[2] suggests, "(1) To yield energy, (2) to build tissue, (3) to regulate body processes."

Digestion, Assimilation, and Nutrition.—The rough masses of food are made available for use in the body by a physiochemical change produced when food is brought in contact with various juices of the alimentary tract. By this change chemical units are separated out to be used in growth of the organism, in the maintenance of the life activities, and repair of parts. These units are taken up by the tissues; they are assimilated into the cells where they will serve. The final result is good nutrition of the organism if sufficient energy has been supplied for action and if a normal body has been secured through a proper supply of building and regulating material.

[1] Sherman, H. C.: Chemistry of Food and Nutrition, The Macmillan Co., New York, 1920, p. xi.
[2] Sherman, H. C.: *Ibid.*

Basal Metabolism.—The foods taken into the body are the source then of energy either for action or for tissue

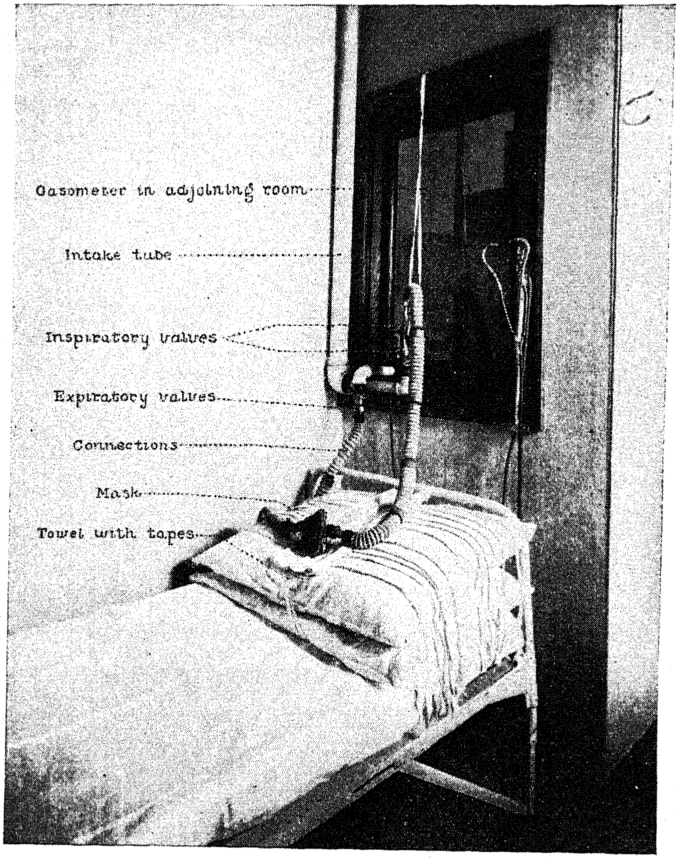

Fig. 85.—Apparatus for determining the basal metabolism. The mask and connections with valves and intake pipe are shown. (Boothby and Sandiford.)

building. They are made available for release of energy by a series of chemical changes that occur in digestion and later in assimilation in the tissues. Chemical changes occur

when energy substances are burned in the body. In these chemical changes, known as metabolism, there is always a production of heat, sometimes apparently as a by-product of the change itself, and again as the chief end or aim of the process. At all events, heat is constantly being produced in the human body, and as energy in its simple form we may think of energy release as heat production. It has long been known that the production of heat in the body varied with many factors, but in recent years efforts have been directed to determine what is normal heat production, so that a standard would be available by which abnormalities could be judged. The heat production of an individual at complete rest and after an interval without food that would exclude the effects of food ingested has been called its basal metabolism (Fig. 85). The basal metabolism is influenced by the activity of the organs, muscles, and blood, and in part by body weight and body surface area. There is some relationship between body weight and body area, but protoplasmic activity of body cells is more significant in explaining basal metabolism. The heat produced by the body is an indication of the metabolic activity of the tissues. DuBois has shown that the basal metabolism of boys is 25 per cent greater than that of adults. His figures follow:

BASAL METABOLISM OF BOYS, MEN AND WOMEN

Subjects.	Age in years.	Calories per hour per square meter.	
		Meeh.	DuBois (height-weight).
Boys..............	12–13	45.7	49.9
Men...............	20–50	34.7	39.7
Women............	20–50	32.3	36.9
Men...............	50–60	30.8	35.2
Women............	50–60	28.7	32.7
Men...............	77–83	....	35.1

This table shows that boys before adolescence have a high rate of metabolism,[1] that men have a higher rate than

[1] Lack of appreciation of the fact that children in the "growing years" have a high basal metabolism is the cause of much undernutrition.

women, and that with advancing age the furnace fires cool down and oxidation is no longer so intense.

Metabolic exchange in the body may be grouped into three distinct forms: (1) basal metabolism; (2) specifically dynamic increase of metabolism from food intake; and (3) work metabolism. These three represent the total heat production. The first type, basal metabolism, represents the oxidative processes of the cells while the individual fasts and rests. The taking of food increases metabolism in the body according to the quantity and the quality of the food. Physical activity still further increases metabolic exchange. The city dweller—especially the sedentary worker—whose exercise is very limited has according to Rubner[1] a daily metabolism of approximately 2600 calories, 24 per cent of which is spent in muscular work. On the other hand, the metabolic exchange of persons engaged in hard labor—woodchoppers for example—amounts to 5600 calories daily, more than 60 per cent of which is applied to muscular work.

These figures by Rubner suggest the physiologic justification for physical activity in revitalizing the body.

Heat is lost from the body by conduction and radiation; by evaporation of water from lungs and skin; and by warming the food ingested and the air breathed. The loss by conduction and radiation and by evaporation are the significant losses. Individuals inadequately clothed for cold weather require that the body burn its food at an increased rate to keep up its basal metabolism. The observation by Lavoisier on this point has been abundantly confirmed.

The close parallel of other physiological functions with metabolic activity is important. DuBois[2] stresses this correspondence as follows:

"The total heat production is directly proportional to the oxygen consumption of the body cells and since the cells must be supplied by the blood an increase in metabolism is accompanied by an increased velocity of blood flow, an increased pulse rate and increased cardiac output. Inas-

[1] *Journal American Medical Association*, January 30, 1926, p. 363.

[2] DuBois, E. F.: Total Energy Exchange in Relation to Clinical Medicine, *Bulletin New York Academy of Medicine*, December, 1933, p. 684.

much as the work of the heart is augmented there is a rise in the coronary circulation and also in the circulation in the lungs. Along with the heightened oxygen consumption there is an increased production of carbon dioxide which must be transported by the blood and excreted through the lungs. Since carbon dioxide is the chief respiratory stimulant the work of the lungs will be proportional to the metabolism. Inasmuch as the increase in the metabolism of the body means a greater formation of heat within the body there must also be a rise in the amount of heat dissipated from the surface. In order to accomplish this the skin must become warmer with an increment in radiation and there must also be a greater vaporization which, under ordinary conditions, takes care of about one quarter of the heat loss. In normal persons the total metabolism for long periods is closely paralleled by the appetite and food consumption, and in long observations weight loss or weight gain is parallel to the discrepancy between total metabolism and total intake."

Caloric Values of Different Articles of Food.—When food is burned in the body heat is produced. The ability of the food to produce heat renders it valuable to the body, and hence food is measured in terms of its heat-producing power. This is called its caloric value, or its power to produce units of heat in the body.

The caloric[1] value of foodstuffs has meant very little to most persons because the gram is usually chosen as the unit of measurement. Tables of common articles of diet giving the caloric value, protein, fat and carbohydrate values, in relation to well-known units of service, such as slice, teaspoonful, tablespoonful, etc., can be found in some of the technical books on dietetics. The most serviceable in this respect is "Feeding the Family," by Mary S. Rose.

Classification of Food.—Foods vary widely in their chemical composition. They also vary, therefore, in the service they give to the animal economy. It has been customary to classify food in terms of the food elements in different

[1] 1 Gm. of protein yields 4 calories.
1 Gm. of fat yields 9 calories.
1 Gm. of carbohydrate yields 4 calories.

varieties of food, but the newer knowledge of nutrition has emphasized certain food factors that are essential for maintenance and growth. A functional classification is to be preferred because of this fact, and also because of the hygienic implications involved. We shall discuss food, therefore, with respect to:

1. Its power to yield energy.
2. Its power to build tissue.
3. Its power to regulate body processes.

It should be noted that some examples of food combine all of these characteristics. Thus, milk and eggs possess the above powers. Good human milk alone is entirely adequate for infants. Many different foods are both yielders of energy and builders of tissue. Many possess the power to regulate body processes. Combinations are essential to secure the three values in the proper proportion.

Food to Yield Energy.—Foods contain three classes of chemical compounds known as carbohydrates, fats, and proteins. The first two are in daily life the main sources of energy. These compounds are widely distributed in food supplies.[1] Meats contain both fats and proteins; eggs have nearly equal amounts of fats and proteins; milk yields carbohydrates, fats, and proteins in almost equal amounts; most cereals contain all three and never less than two (fat insignificant in amount); most nuts are rich in protein and fat; and vegetables with few exceptions contain all three, with the carbohydrates in largest amount. The foodstuffs economical for energy are the carbohydrates and fats.

A recent study[2] indicates that wheat now constitutes about one fourth of the calories of the American diet. If wheat contains about 70 per cent carbohydrates, wheat represents the most important source of carbohydrates in the diet. Bread is not a complete food, nor is it an important

[1] There are no special system foods. The nervous system is dependent upon the same food sources for its energy that supply the other systems of the body. The term "brain food" or "nerve food" is a misnomer. (See Fig. 86.) Sanatogen has been advertised extensively as a "nerve food and tonic." It was never so regarded among scientific people.

[2] Food Research Institute, Stanford University, February, 1929.

source of protein, mineral salts, vitamins, or roughage. Its value is in the carbohydrates it supplies. While whole wheat contains certain valuable ingredients absent in white flour, the deficiencies can be supplied readily by the other foods used. Since bread made from either whole wheat or white flour needs to be supplemented for a suitable diet, the emphasis upon whole wheat bread as an indispensable article of food is greatly overdrawn.

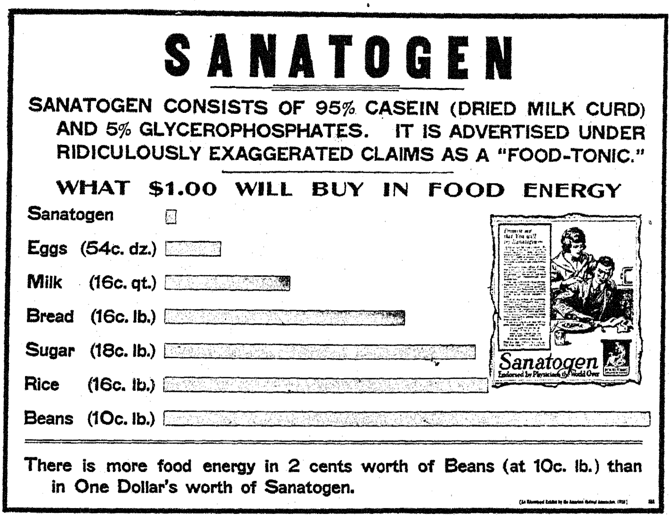

Fig. 86.—Energy is obtained more surely from wholesome food than from special patented preparations. (By courtesy of the American Medical Association.)

(*a*) *Carbohydrates.*—The carbohydrates include the simple sugars and the starches that by digestive processes are changed into sugars. After digestion the sugars are taken by the circulation to the liver, where they are stored in the form of glycogen. As sugar is needed in the body the supply in the liver is drawn upon, and thus in the hours between meals carbohydrate is always available for energy.

The combustion of carbohydrates may follow one of several possible courses, but it leads eventually to carbon

dioxide and water. The rate of combustion depends upon the activity of the body. Oxygen is necessary for this combustion, and unless some unusual condition impede, the supply of oxygen will be maintained sufficient for body needs. If the carbohydrate is abundant, it may result in the saving of fat for the time, so that the fat of the diet will be stored in the body tissues.

It is well known also that fat may be formed from carbohydrate. Numerous experiments have demonstrated this fact. The evidence of a practical kind is given by those people of overweight proportions who partake freely of carbohydrate foods, such as potatoes, candy, cereals, and bread.

In earlier conditions of civilization all foods in their natural and unrefined state were more freely used than they are today. Sugars, for example, were immediately available in such foods as fruits, melons, honey and milk. Today sugars have taken an increased share in man's dietary as the processes of food manufacture have developed.

Sherman[1] states that the proper place of sugar in the diet is not in such concentrated forms as candy nor in the effective sweetening of all kinds of foods, but rather as a protective and flavoring to facilitate the introduction to the children's diet of larger amounts of fruits and milk. Practical lessons to be learned from the newer knowledge of nutrition reveals the importance of giving a more prominent place in our eating habits to the protective foods, that is, milk, fruit, and some of the vegetables.

(*b*) *Fats.*—The fats are widely distributed in nature and occur in both the animal and vegetable kingdoms. They are represented in milk, cream, butter, nuts, olive oil, and other vegetable oils. After digestion of food containing fats the end-products of the change pass into the circulation and thence into the tissues. They may be burned at once to produce energy, stored for use as fuel at a late time, or bound in chemical combination to produce tissue fat. Some of the fat enters into combination with proteins,

[1] Sherman, H. C.: Problem of Sweets for Children. *American Journal of Public Health*, November, 1929.

phosphorus, and other substances to form complex compounds (*e. g.*, lecithin) found especially in the nervous system.

For the liberation of energy fat is burned and yields finally carbon dioxide and water. This energy production is high. While 1 Gm. of carbohydrate yields about 4 calories, 1 Gm. of fat yields about 9. We recognize, therefore, that fat is a food of high fuel value and useful primarily as a source of energy.

Food to Build Tissue.—Proteins are of importance chiefly as tissue builders and are the only available source of nitrogen. They are found in animal and plant tissues. More complex in chemical structure than the carbohydrates and fats, they have at last yielded to scientific methods, so that their terminal digestion units, called amino-acids, are well known. Not all proteins are alike in the amino-acids yielded, and the amino-acids themselves vary greatly in their ability to build tissue. Osborn, McCollum, and others have shown that certain proteins obtained from wheat (gliadin), rye (gliadin), pea (legumin), barley (hordein), maize (zein), and kidney bean (phaseolin) may maintain life, but are not sufficient to promote growth. The growth proteins of value are from milk (casein), hemp seed (edestin), wheat (glutein), maize (glutelin), and squash seed (globulin). Such experiments would indicate the importance for growing children of milk, whole wheat, and unprocessed corn, to mention the foods in the above group commonly used.

The relative value of meat and vegetable proteins for growth and life processes in general has not been finally determined. Certain results have been secured by careful feeding experiments, but more remains to be done before a final statement can be made. The animal proteins, if milk and eggs are included, and of course they should be, are distinctly superior as sources of nitrogen for the body.

The proteins of vegetables as they occur in the ordinary diet are not so easily digested and utilized as the meat proteins. For growth purposes McCollum[1] says: "These

[1] McCollum, E. V.: Newer Knowledge of Nutrition, The Macmillan Co., New York, p. 77.

(muscle tissue proteins) are distinctly better than those of the seeds with which investigations have been conducted." Sherman[1] notes: "Hoobler has shown that milk is the best form of food protein for the production of human milk and the protection of the body protein of the nursing mother."

Protein is the only food containing nitrogen and nitrogen is essential for life. The body is continually using nitrogen in its metabolic activities, and the amount used can be determined by measuring the amount of nitrogen in the waste eliminated. If the nitrogen of the food and the nitrogen of body waste are determined, it is possible to compute the nitrogen intake and output. If the output exceeds the intake, it means that the body is burning its own protein to supply its needs. By reducing the intake to the minimum where output and intake balance we reach a point of equilibrium known in chemistry as "nitrogen equilibrium." It has been held that meat proteins were more usable in the body. Burton-Opitz[2] states that, to secure nitrogen equilibrium, "we need 30 Gm. of the proteins of meat, 31 Gm. of the proteins of milk, 54 Gm. of the proteins of beans, 75 Gm. of the proteins of bread, 102 Gm. of the proteins of corn." On the other hand, Sherman[3] has shown recently that nitrogen equilibrium can be maintained on a diet of cereal grains of 35 to 45 Gm. of protein per man of 70 Kg. per day. "An allowance of 1 Gm. of protein per kilogram of body weight per day provides a margin of safety of from 50 to 100 per cent above the minimum actually required to maintain equilibrium." For palatability's sake meat protein is superior to vegetable protein, but for health's sake, it has been argued that the protein allowance per day should not exceed 100 Gm., and that meat in contributing to that maximum should not be used more often than once a day. It may be that the

[1] Sherman, H. C.: *Loc. cit.*, p. 226.

[2] Burton-Opitz, R.: Text-book of Physiology, W. B. Saunders Co., Philadelphia, 1920, p. 1057.

[3] Sherman, H. C.: The Protein Requirement of Maintenance in Man, *Proceedings National Academy Sciences*, pp. 38–40, January, 1920.

nutrition experts have been too severe in this matter. Lieb[1] reports the studies made on Stefansson and Andersen, two arctic explorers. The data presented conflict with prevailing ideas of protein metabolism. Before this study Stefansson had lived for seven years on an exclusive meat diet which left no physical sign of impairment upon him. It may be said with some certainty that in view of the conflicting opinions the last word has not been said on this subject.

The diet in Germany during the war failed miserably in maintaining health and was inadequate for work of physical or mental kind. Lusk[2] reports a table presented by Rubner showing the rationed foods as planned and as actually provided:

German Diet during the World War

	As planned:			As actually provided:		
	Amount.	Protein, grams.	Calories.	Amount, grams.	Protein, grams.	Calories.
Bread	271.0 gm.	17.2	688	271.0	17.2	688
Potatoes	710.0 gm.	14.9	710	357.0	7.5	341
Butter and margarine	18.0 gm.	....	140	11.4	....	89
Milk	200.0 c.c.	6.8	111			
Meat	70.0 gm.	10.7	158	36.0	4.5	78
Eggs	0.3 gm.	4.2	53	0.07	1.0	13
Sugar	32.0 gm.	....	125	26.0	....	104
Cereals	....	....	....	9.8	0.9	31
Totals	....	53.8	1985	......	31.1	1344

"The exclusion of animal foods from the diet made it monotonous, and for many it was not better than the fare of prisoners sixty or seventy years before." Moreover, as Lusk later says, "The mixed diet of peace time showed a loss of 10 per cent of nitrogen, while the coarse vegetarian

[1] Lieb, C. W.: The Effects on Human Beings of a Twelve Months' Exclusive Meat Diet, *Journal American Medical Association*, July 6, 1929, pp. 20–22.

[2] Lusk, Graham: Physiological Effect of Undernutrition, *Physiological Reviews*, October, 1921, pp. 523–552.

war diet showed that 20 or even 50[1] per cent of the nitrogen of the diet could not be absorbed."

The present evidence would seem to indicate the value of animal proteins for growing children. For adults, when growth is not important, the proteins must be judged not as to *source*, but as to *composition*.

Composition of Vegetable and Animal Proteins.—Although there is conflicting evidence and opinion as regards the relative value of animal and vegetable protein, there is general agreement that the *sources* differ markedly in *composition*. This difference lies chiefly in the amount of nucleoprotein available. This is of importance because nucleoprotein is the source of the purine bases, complex products of protein metabolism, and substances directly related to the production of gout and probably related to the efficiency and health of the kidneys.

In writing of the purines Rose[2] says: "These purines are not nutritious, but are gradually transformed in the body to uric acid, to be carried off as waste in the urine. Persons inclined to gout have difficulty in getting rid of uric acid, and the more meat they eat, the more uric acid tends to accumulate in the system, circulating in the blood and depositing in the joints. If protein is taken in moderation and chiefly from eggs, milk, cheese, bread, and nuts, which contain no purines, dangers of this difficulty may be avoided. . . . For persons of indoor sedentary life a very liberal use of meat is certainly undesirable. Even athletes, for whom meat was once thought especially necessary, have demonstrated the possibility of reducing their daily consumption to one sixth the amount which the training table previously provided, with an actual increase in their capacity for endurance."

The following foods are practically purine free: milk,

[1] This would apparently lower the protein intake below 16 Gm. War diets in some areas of Germany under observation by American officers showed a total calorie yield of 1200 to 2000. This lowering of the protein intake and of the caloric value of the diet was not incompatible with life because the basal metabolism was probably reduced. But there was noticed a very great susceptibility to infections. Patients in hospitals and welfare institutions died in great numbers.

[2] Rose, M. S.: Feeding the Family, The Macmillan Co., New York, 1919, p. 68.

eggs, cheese, sugars, breadstuffs made with white flour, fruits, nuts, rice, potatoes, all root vegetables, most green vegetables (spinach and asparagus excepted), fats, and oils. The foods of high purine are: sweetbreads, kidney, roe, liver, and sardines. Those fairly high in purine are: beef, veal, mutton, pork, chicken, turkey, goose and other game, fish (cod excepted), spinach, asparagus, peas, and beans.

It should be clear that the primary function of the diet is to supply the chemical substances necessary for the growth and repair of the organism and energy for the production of heat and work. It has been demonstrated that the carbohydrates, fats, and proteins may supply energy but that proteins are primarily builders of tissue. For this purpose of growth and repair of tissue, animal protein is of better quality than vegetable protein, and the protein of milk, eggs, and glandular animal tissue, such as liver, is especially valuable. Dependence upon flesh sources only for protein is a mistake.

Food to Regulate Body Processes.—Mendel and Osborn[1] reported their results on feeding different proteins. They showed that rats require for normal growth certain of the 17 amino-acids which are the structural units of all proteins. Now, no matter what combination of foods they used, the animals failed to grow unless there were present in the diet two things: "one present in butter fat and absent in lard; another present in milk, but which was not protein, fat, carbohydrate, or mineral. These x and y of Mendel's experiments were noted in papers published simultaneously with Funk's announcement of Vitamin in 1911."[2] McCollum, working along similar lines, gave the names "fat-soluble A" and "water-soluble B" to these substances. Lately a third substance has been discovered, water-soluble C. The three types are usually designated by physiologic chemists as vitamin A, B, and C. Continued study with dietaries soon revealed other vitamins. Numerous workers showed the relation of sunlight, and vitamin D to the

[1] Mendel and Osborn: Feeding Experiments with Isolated Food Substances, Carnegie Institute, Washington, Publication No. 156.
[2] Sherman, H. C.: *Loc. cit.*, p. 226.

deposit of calcium phosphate in the bones and hence its relationship to rickets. Only recently another vitamin has been identified, vitamin E, which influences reproduction. It has been called the antisterility vitamin.

How Vitamins Affect Nutrition and Growth.—Numerous experiments by Osborn, Mendel, Funk, Vedder, Takaki, McCollum, and his co-workers definitely prove that nutrition and growth are profoundly affected by the vitamins of food. Not only do specific diseases develop if the vitamins are absent, but malnutrition of all grades occurs when the vitamins are not in sufficient amount. Scurvy and beriberi

Fig. 87.—Rat fed on diet containing adequate protein, minerals, and vitamins.

have lately been termed deficiency diseases because of being caused by a diet deficient in vitamin, C in the former and B in the latter. McCollum[1] gives numerous illustrations of the damage done by a diet in which the vitamin element is deficient. Eddy[2] said in 1920 that rickets which were formerly considered to be due to a lack of calcium salts

[1] McCollum, E. V.: *Loc. cit.*, entire book; McCollum and Davis, *Journal Biological Chemistry*, 1915, vol. 23, 231; McCollum, Simmonds, and Pitz, *American Journal Physiology*, 1916, vol. 41, 333, 361; McCollum, *Journal American Medical Association*, May 12, 1917, pp. 1579–1586.

[2] Eddy, W. H.: Vitamines and Babies, *Teachers College Record*, p. 103, March, 1920.

has been stated by McCollum to be due to a deficiency of any two of four factors—quality of protein, mineral salts, fat-soluble A, and water-soluble B. Later evidence attributes rickets to vitamin D. In this connection it is interesting that calcium, phosphorous, sunlight, and ultraviolet rays supplied artificially will substitute for this vitamin (Figs. 87, 88). Natural foods are conspicuously lacking in this vitamin. Milk contains little, egg yolk more, but cod liver oil

Fig. 88.—Rat fed on diet deficient in vitamin A. Note the inflamed eye. This is called xerophthalmia.

is the only natural source available to the public which contains an abundance of vitamin D. Marasmus has shown some evidence of connection with the A and B vitamins and scurvy has been linked with the C vitamin. A vitamin E has been called the antisterility vitamin because of the relation between sterility and certain diets. Vitamin E is highly present in butter and wheat germ; some oils and fats, such as lard counteract the effect of vitamin E. It should be noted that while the vitamin content is extremely

TABLE IV

Composition[1] of Common Foodstuffs

with reference to

1. Calories yielded per 100 Gm. of weight,
2. Percentage of carbohydrates (CH.), proteins (Pr.), and fats in foods, and
3. Relative amounts of vitamins A, B, C, D, and G in foods. The numbers are to be interpreted as follows:
1 = excellent source for the vitamin,
2 = good source, 3 = fair, 4 = poor or none.

Foodstuffs, edible portions.	Calories per 100 Gm.	Percentage by weight of.			Vitamin content.				
		CH.	Pr.	Fat.	A	B	C	D	G
Meats and Poultry Products:									
Bacon	625	..	10	65	4	3	4	4	3
Beef, round	242	..	20	18	3	2	3	3	2
Chicken	109	..	21	2	3	2	3	.	2
Egg, yolk	363	..	16	33	1	2	4	1	1
Egg, white	51	..	12	..	4	4	4	4	2
Fish, cod	462	..	11	..	3	3	4	3	3
Fish, salmon	203	..	22	13	3	3	4	3	2
Gelatin	367	..	91	..	4	4	4	4	.
Ham	266	..	20	21	4	2	4	4	2
Liver, beef	129	1	20	4	1	1	2	1	1
Lobster	84	..	16	2	.	3			
Mutton	191	..	20	12	3	2	3	3	2
Oysters	50	4	6	1	2	2	3	2	2
Pork, chops	337	..	17	30	3	2	4	4	2
Turkey	291	..	21	23	3	2	3	4	2
Veal, cutlet	150	..	20	8	3	3	3	3	3
Dairy products:									
Butter	796	..	1	85	1	4	4	2	4
Buttermilk	36	5	3	..	3	2	4	4	1
Cheese, American	440	..	29	36	1	3	4	2	
Cream	195	5	3	19	1	2	3	2	1
Ice cream	222	20	4	14	2	2	4	2	1
Milk, whole	69	5	3	4	1	2	3	2	1
Vegetables:									
Asparagus	22	3	2	..	2	1	2	4	2
Beans, green	42	7	2	..	2	2	2	4	2
Beans, baked	129	20	7	2	3	2	4	4	3
Beets	46	10	2	..	3	3	3	4	3
Cabbage	32	6	2	..	3	2	1	4	2
Carrots	46	10	1	..	1	2	2	4	2
Cauliflower	30	5	2	..	3	2	2	4	2
Celery	19	3	1	..	3	2	2	4	3
Chard	30	4	3	..	1	2	1	4	2
Lettuce	19	3	1	..	3	2	1	4	2
Mushrooms	45	7	3	..	.	2	.	4	
Onions	49	10	2	..	3	3	2	4	3
Peas, dry	355	62	25	1	3	2	4	4	2
Peas, green	100	20	7	..	2	2	1	4	2
Potatoes, white	83	18	2	..	3	2	2	4	2
Rhubarb	23	4	1	1	3	.	2	4	
Sauerkraut	27	4	2	..	3	3	3	4	3
Spinach	24	3	2	..	1	2	1	4	2
Tomatoes	23	4	1	..	2	2	1	4	2
Turnips	39	8	1	..	3	2	2	4	2

[1] The data in this table are taken from many sources. The percentage of food elements is given in whole numbers; 0.5 or less percentage is omitted.

Foodstuffs, edible portions.	Calories per 100 Gm.	Percentage by weight of.			Vitamin content.				
		CH.	Pr.	Fat.	A	B	C	D	G
Fruits:									
Apples	125	14	..	..	3	2	2	4	3
Apricots	58	13	1	..	1	2	3	4	
Avocados	139	7	2	20	3	2	3	4	2
Bananas	105	22	1	1	2	2	2	4	3
Cherries	78	17	1	1	2	3	2	4	
Cranberries	48	10	..	1	.	.	3	4	
Dates, dried	347	78	2	3	3	3	4	4	
Figs, dried	317	74	4	..	3	.	4	4	
Grapefruit	52	12	1	..	3	2	1	4	2
Grapes	96	20	1	2	3	3	3	4	
Lemons	44	8	1	1	3	2	1	4	2
Oranges	51	12	1	..	2	2	1	4	2
Peaches	41	9	1	..	2	2	2	4	2
Pears	63	14	1	..	3	2	3	4	2
Prunes	367	73	2	7	2	2	4	4	
Strawberries	39	7	1	1	3	3	1	4	
Cereals:									
Bread, white	260	53	9	1	3	3	4	4	3
Bread, whole	246	50	10	1	3	2	4	4	3
Corn meal	356	75	9	2	3	3	4	4	4
Macaroni	358	74	13	1	3	.	4	4	
Oatmeal	399	67	16	7	4	2	4	4	3
Rice, white	351	79	8	..	4	4	4	4	4
Soy bean, meal	377	7	40	21	.	.	4	4	
Nuts:									
Almonds	647	17	21	55	3	2	4	4	
Cocoanut, dry	669	31	6	57	3	2	4	4	2
Peanuts	548	13	11	71	3	2	4	4	
Walnuts, English	705	13	18	64	3	2	4	4	

important in the diets of growing children, adults avoid the danger to a degree because their diet is varied. Ordinary fresh foods are the simplest, cheapest, and richest sources of vitamins and if properly selected will supply adequate vitamins for adult needs without recourse to the drug store. The commercialization of the interest in vitamins would lead persons to believe that vitamin tablets, yeast, and other preparations are essential to health. Their true value is in provision of means to correct faults in dietary selection, but properly selected natural foods can supply all that is needed.

The deleterious effects of lack of vitamins in food are observed in malnutrition and defective growth. These are observed superficially in deficiency in weight or small size and weakness. Stene and Roberts[1] report that unsatisfactory

[1] Stene, Jessie A., and Roberts, Lydia J.: A Nutrition Study on an Indian Reservation. *Journal of American Dietetics,* March, 1928.

sanitation and inadequate diets doubtless are responsible for the physical deterioration of the Sioux Indians on the reservations in South Dakota. The diet of these Indians shows a lack of calcium and vitamin A. The Indians observed exhibited poor teeth, bowlegs, sore eyes, and blindness. Among a number of families the diet is principally bread and coffee. There are, however, more profound changes in the internal organs, and consideration of how vitamin deficiency affects the body should include recognition of the alteration of cellular elements in brain, heart, pancreas, and other vital organs.

The integrity of the organic systems is more significant than the usual judgment based on external change. Proper interpretation would always regard authentic external appearance as evidence of internal conditions. Moreover, it is with this same measure that underweight in general is to be examined. The individual in poor nutrition is not only lacking in weight; the significant deficiency is represented in the changes in heart muscle, brain cells, and like structures.

Foods and Vitamins.—Table IV, page 236, adapted and brought up-to-date by reference to the latest data, shows the relative amount of vitamin A, B, C, D, and G present in different foods used by man.[1]

Characteristics of the Different Vitamins.—The several vitamins have quite unique and distinctive qualities. Some perish readily under the processing or cooling of the raw material before it is eaten. Since most foods reach the table changed in form from that of their natural state, either through cooking, canning, pasteurization, or other chemical or physical method, it is important to know to what extent vitamin is changed or lost by such procedures.

Vitamin A.—In the early years of vitamin research, only three were recognized: A, B, and C. Today there are not less than eight and probably nine. The tabulation (page 239) indicates how A and B have yielded substances that have since been identified as separate and distinct.

[1] The relative amount of E has not been sufficiently determined to be included in the table.

Vitamin A

- Vitamin A
- Vitamin D
- Vitamin E

Vitamin B

- Vitamin B_1
  - Vitamin B_3
  - Vitamin B_4
  - Vitamin B_y
- Vitamin B_2

Vitamin A may be called the growth vitamin, but for this purpose, the minerals iron and calcium must supplement A and be accompanied by sufficient calories to fulfill the needs of the cells. The best source of A and calcium is milk. Sherman attributes large health benefits to the addition of milk to an already adequate diet. The reduction in death rate, better growth, and improvement of life expectancy are assigned by him to "this increase in the proportion of milk in an already adequate diet." The addition of milk and cod liver oil to the diet of industrial workers has increased their weight and decreased absences from work. Remarkable improvements in the health of infants and children have resulted from feeding cod liver oil. Although the rôle of vitamin A is best known in promoting growth, it may also possess powers to combat infection. There are some indications of this, although the case is not clearly established.

The A vitamin is affected as follows: Eddy[1] says, "Heat alone is of very limited effect, but where sources are heated in the presence of oxygen, destruction of the vitamin may be very rapid. . . . Cooking of vegetables will not, as a rule, result in appreciable destruction of this factor. . . ." The many lard substitutes now in use must in general be considered A vitamin free regardless of the content of the A in the fats from which they are derived, unless they have been made by blending instead of hydrogenation.

The question of the effect of heating on the vitamin has not been settled because the factors vary markedly. Sherman, MacLeod, and Kramer state that "dry heating at a temperature of 100° C. with free access of air only very slowly destroyed fat-soluble vitamin." They go on to say:

[1] Eddy, W. H.: The Vitamin Manual, Williams and Wilkins Co., Baltimore, 1921, pp. 63, 64.

"The results thus far obtained emphasize the importance of taking full account of the time as well as the temperature of heating, and of the initial concentration of vitamin in the food as well as the opportunity for previous storage of the vitamin by the test animal."

Physiological research has recently given evidence to the effect that vitamin A is not only essential to growth in the young, to proper dentition in both young and old, but also to resistance to various types of infection. In an excellent article on vitamins Eddy[1] says: "—with the increasing evidences of the importance of vitamin A to protection against colds, sinus infections, kidney and bladder infections, tuberculosis, and even deafness of certain infectious origin, the field of exploitation of vitamin A preparations for human health protection becomes much enlarged. But we still lack much knowledge of this factor that would be of value in controlling this exploitation."

Sherman stresses the modern view of nutrition which may be expressed as the *optimum* state of nutrition; this view is opposed to the older concept that sought to secure minimum requirements. In writing of vitamin A, Sherman[2] says, "It seems important, then, to insure such food supplies and to cultivate and inculcate such food habits as shall keep the bodies of people of all ages well stocked with vitamin A at all times."

Vitamin B.—The vitamin B will not be appreciably affected in ordinary cooking temperatures if alkali is not used. Therefore, the canning or preserving of food by the addition of bicarbonate of soda at the time of preparation is detrimental to the B vitamin. The use of soda in the cooking of vegetables "to soften the vegetable and accelerate the cooking" is destructive of vitamin B.

At first it was believed that vitamin B was a single factor but research has broken it up into at least 5 parts. In England these are known as B_1, B_2, B_3, B_4, and B_5 but in

[1] Eddy, W. H.: Vitamins. *Medical Journal and Record*, June 3, 1931, p. 522.

[2] Sherman, H. C.: Food and Health, By permission of The Macmillan Company, publishers, 1934, p. 117.

America the B_2 which was first separated is called vitamin G, following the procedure of naming with letters new factors recognized. Using the English terminology it may be noted that B in its different parts serves various purposes:

B_1—The antineuritic factor that protects against polyneuritis but does not promote normal growth when used as the sole source of vitamin B. Plimmer reports that a slight shortage of B_1 produces ill health characterized by symptoms of indigestion, constipation, headache, anemia, unhealthy skin, and abnormal heart action. Marked reduction of this vitamin produces **beriberi,** a disease frequently found in the Orient. The Medical Research Council of England reports: "Yeast is the richest known source of vitamin B_1."

B_2—This corresponds to vitamin G. It protects against certain forms of dermatitis. Essential for growth but when used alone not adequate. Omission of this vitamin from the diet leads to pellagra. It is richly present in milk, eggs, tomatoes, asparagus, beet leaves, and yeast.

B_3—Found necessary for growth in pigeons in addition to B_1.

B_4—Found necessary in addition to B_2 and B_3 for growth in rats. Different character from B_3.

B_5—Recently proposed as essential for growth in pigeons but different in character from B_3.

Sherman[1] advises as follows: "If half of the needed food calories are taken as fruits, vegetables, milk, and eggs, and if half of whatever breadstuffs and cereals are used are taken in the whole grain, or "dark," or "unskimmed" forms, there will almost certainly be provided an ample supply of vitamin B—and of many other important nutritional factors as well."

Vitamin C.—The omission of this vitamin from the diet produces scurvy, a disease that scourged sailors in the days of sailing ships. The vitamin is richly present in oranges, lemons, cabbage, tomatoes; apples, bananas, carrots, and other vegetables also contain the substance. Cooking injures the vitamin and the longer the cooking, the greater

[1] Sherman, H. C.: Food and Health, By permission of The Macmillan Company, publishers, 1934, p. 129.

the damage. The C vitamin is more sensitive than A or B. Temperatures above 50° C., according to Eddy, are usually destructive, although the time factor is extremely important. Recent experiments, however, indicate that the presence or absence of oxygen is a more important factor than heat alone. Hess, for example, has found that the temperature used to pasteurize milk continued for some time is more destructive to vitamin than boiling water temperature continued for only a few minutes. The extent to which orange juice and tomato juice resist high temperatures indicates the protective action of acids to be considerable.

The cooking of cabbage destroys about 90 per cent of its vitamin C. If alkali is added to vegetables in cooking, most of the vitamin is lost.

Dehydration of vegetables destroys, in most instances, the C vitamin. Hess[1] suggests that dehydration was "the greatest cause of scurvy in the Central Empires" during the World War.

Young fresh vegetables contain more C vitamin than old ones. These considerations all indicate the need for man to secure fresh natural food products so far as possible; to avoid those that have been treated chemically and in other ways. As regards milk, it is unquestionably better to use pasteurized milk in which the vitamin C has been decreased and to make up this deficiency in other foods, than to court tuberculosis and dysentery by the use of raw milk. It is probably utopian to ever expect that city children will receive, generally, clean raw milk. The care of milch cows and the gathering of milk present openings in our public health armor that are best cared for by pasteurization.

Recent investigations have shown the relationship of vitamin C to dentition. No single chemical should be assigned the full responsibility for proper growth, development, and health of the teeth and gums. Calcium, phosphorus, vitamins D, A, and B have rôles in these processes, but the recent evidence indicates that vitamin C has a most important part to play.

[1] Hess, A. F.: Newer Aspects of Some Nutritional Disorders, *Journal American Medical Association*, March 12, 1921.

Vitamin D.—Egg yolk seems to be the natural food with the highest antirachitic value. Green vegetables contain small quantities as does also milk. Cod liver oil is very rich in this vitamin and to prevent rickets it is recommended for babies. and young children, especially during the winter months. Considerable evidence points to its value in the prevention of dental caries (Chapter XIV).

In writing of vitamin D, Eddy[1] states the following: "Nature equipped fish oils rather lavishly. When she came to mammalian and bird diets she was less generous and outside of egg yolk the natural foods that contain vitamin D are few in number and low in potency." Research in the nature of vitamin D has been prolific. Windaus' work along this line gained for him the Nobel prize. He gave the proof that ergosterol is the chemical precursor of vitamin D. From this work, the action of ultraviolet rays in making the vitamin active was explained and the rationale of sun baths and the irradiation of certain foods were made clear. At present manufacturers are attempting to exploit these discoveries. Foodstuffs are irradiated, various lamps are advertised for this purpose, bread is being made by one concern with measured amounts of irradiated ergosterol, cigarets and even cold cream appeal for sale on the basis of their vitamin D potency. The greatest problem, however, is not how to get vitamin D but rather how much do we need for health, for growth and development.

Vitamin E.—This vitamin appears most abundant in the oil of the wheat germ, but is also generally found in seeds and green leaves. It is not readily destroyed so that cooking processes do not impair its value. Deficiency of A may impair reproduction quite as much as deficiency in E and development of the infant is more endangered by deficiency in C and D than in E.

Vitamin G—See the discussion under B_2.

Mineral Salts as a Dietary Essential.—The mineral salts occupy a very important place in the dietary. They are not burned to produce heat, but they do help to build tissue and

[1] Eddy, W. H.: Vitamins, *Medical Journal and Record*, June 3, 1931, p. 523.

in regulating body processes. They are to be considered as a constituent of food of prime importance. Thus Sherman,[1] in speaking of "mineral metabolism" and the functions of salts, says that they serve in three ways:

(1) As bone constituents, giving rigidity and relative permanence to the skeletal tissues.
(2) As essential elements of the organic compounds which are the chief solid constituents of the soft tissues (muscles, blood cells, etc.).
(3) As soluble salts (electrolytes) held in solution in the fluids of the body, giving these fluids their characteristic influence upon the elasticity and irritability of muscle and nerve, supplying the material for the acidity or alkalinity of the digestive juices and other secretions, and yet maintaining the neutrality or slight alkalescence of the internal fluids as well as their osmotic pressure and solvent power.

Composition of the Body in Terms of Its Elements.—Sherman[2] gives the elementary composition of the human body as follows:

	Per Cent.
Oxygen, about	65
Carbon, about	18
Hydrogen, about	10
Nitrogen, about	3
Calcium, about	2
Phosphorus, about	1
Potassium, about	0.35
Sulfur, about	0.25
Sodium, about	0.15
Chlorine, about	0.15
Magnesium, about	0.05
Iron, about	0.004
Iodine	Very minute quantities
Fluorine	Very minute quantities
Silicon	Very minute quantities

The Rôle of Mineral Salts in Food.—The presence or absence of salts essential to body metabolism is an important matter. The correct understanding of the possibility of foods supplying these essentials will help to correct the rather prevalent notion that these valuable ingredients are only to be secured by taking "patent medicines," extravagantly advertised and claiming unwarranted values.

[1] Sherman, H. C.: Chemistry of Food and Nutrition, The Macmillan Co., New York, 1920, p. 236.
[2] *Ibid.*, p. 234.

Carbon, hydrogen, and oxygen are always found in the three foodstuffs, so that these elements are abundant. Available nitrogen is found only in protein, and this explains why health cannot be maintained on a diet of only carbohydrates and fats.

Sodium, potassium, and *magnesium* are supplied in sufficient amounts in food without any care in the selection for this purpose. The amount of sodium chloride added to food is much more than sufficient for the body needs; potassium and magnesium are fairly abundant in meat (muscle) and in vegetables, so that an ordinary mixed diet with some roughage will contain sufficient amounts of these substances.

Calcium, relatively large in the salt content of the body, is quite irregularly distributed among staple food articles. Milk, however, contains it in abundance, and if sufficient milk is used this element will be provided adequately. The calcium needs of the body must be provided, especially in infancy and childhood and during pregnancy.[1] Lusk[2] emphasizes the importance of calcium during pregnancy, especially during the last ten weeks. Sherman[3] in speaking of the requirements, says, ". . . It would seem that the food of a family should furnish at least 0.67 Gm. of calcium or 0.9 to 1 Gm. of calcium oxide per man per day." And later he[4] says, "Apparently the American dietary is more often deficient in calcium than in any other element; certainly more attention should be paid to the choice of such foods as will increase the calcium content of the dietary. The use of more milk and vegetables with less meat and sugar will accomplish this and usually improve the diet in other directions as well." It is important at this point to remember that McCollum says that milk and leaf vegetables will correct the dietary deficiencies of other foods in respect to vitamins. The importance of milk as an article of food is seen to be very great. The most practical means of securing an adequate calcium supply is to use milk freely.

[1] For discussion of diet and dental caries, see Chapter XIV.
[2] Lusk, G.: The Science of Nutrition, W. B. Saunders Co., 3d ed., 1919, pp. 389, 390.
[3] Sherman, H. C.: *Loc. cit.*, p. 267.
[4] *Ibid.*, p. 268.

It is important to note that the "milling" of grain removes a large amount of calcium. White flour, polished rice, and new process corn meal are very poor in calcium. The fruits and vegetables are quite rich in calcium, especially prunes, oranges, carrots, and cabbage. The sulfur content will be adequately provided if the protein supply is sufficient. The sulfur needs are about 1 Gm. per day, and if about 100 Gm. of protein are used adequate sulfur will be secured.

Phosphorus.—On the other hand, phosphorus may not be found in sufficient amount in dietaries, and since, like calcium, it represents an important part of the body structure, there should be care to avoid a deficiency. Phosphorus is present in the human body chiefly in bones, milk, brain, nerve, and sexual tissue, and is essential in all body cells. The phosphorus requirement is given by Sherman[1] as "1.44 Gm. (3.30 Gm. P_2O_5) corresponding to a 'protein standard' of 75 Gm." The evidence from many sources[2] indicates that organic phosphorus compounds are of no more value as food than are the inorganic phosphates. This evidence is significant because of its bearing upon the blatant claim of manufacturers who offer organic phosphates in patent medicines as "tonics, restorers, and strengtheners." Food should be chosen that would provide this necessary element. (See Table V.)

White flour is very poor as a source of phosphorus because milling has removed the salt which is deposited in the outer shell of the kernel.

The significance of an adequate phosphorus content of the blood is very great in children and especially in the first years of life. Occurrence of a depleted phosphorus content in the blood of a young child almost always means rickets,[3]

[1] Sherman, H. C.: *Loc. cit.*, p. 255.

[2] Forbes and Keith: Ohio Agricultural Experiment Station Technical Bulletin, No. 5, p. 357. McCollum, Halper and Drescher, *Journal Biological Chemistry*, 1912, p. 219. Marshall, *Journal American Medical Association*, 1915, p. 573. Sherman, Nettler, and Sinclair, United States Department of Agriculture, Office Experiment Station Bulletin 227, 1910.

[3] Howland, J., and Kramer, B.: *American Journal Diseases of Children*, August, 1921. Jones, M. R., and Nye, L. L., *Journal Biological Chemistry*, July, 1921. Von Meysenburg, L., and McCann, G. F., *Journal Biological Chemistry*, August, 1921.

TABLE V

AMOUNTS OF PHOSPHORUS AND CALCIUM IN 100-CALORIE PORTIONS OF SOME COMMON FOOD MATERIALS

Food material.	Measures of portion.	Phosphoric acid, grams.	Calcium oxid, grams.
Buttermilk	1⅛ cups	0.61	0.415
Codfish, fresh	5 ounces (uncooked)	0.60	
Celery	4 cups 1¼-inch pieces	0.54	0.54
Spinach	2½ cups (cooked)	0.54	0.37
Haddock, fresh	5 ounces (uncooked)	0.50	
Lettuce	2 large heads	0.47	
Cauliflower	½ medium head	0.45	0.55
Beef, lean	2¼ ounces (uncooked)	0.42	0.009
Cheese, cottage	5½ tablespoonfuls	0.40	
Asparagus	20 stalks	0.39	
Cheese, hard	1⅛-inch cube	0.329	0.25
Beans, dried	⅛ cup (uncooked)	0.326	0.063
Milk	⅝ cup	0.303	0.239
Rhubarb	4 cups 1-inch pieces	0.30	
Turnips	2 cups ½-inch cubes	0.292	
Beans, string	2¼ cups 1-inch pieces	0.284	0.177
Cabbage	5 cups (shredded)	0.28	0.214
Egg yolk	2 yolks	0.27	
Tomatoes	1¾ cups (cooked)	0.257	0.087
Peas, dried	2 tablespoonfuls (uncooked)	0.25	
Eggs	1⅓ eggs	0.24	0.06
Onions	3 to 4 medium	0.24	0.12
Peas, fresh	¾ cup	0.24	
Oatmeal	1 cup (cooked)	0.216	0.03
Corn, green	½ cup	0.21	
Bread, graham	2 slices	0.19	
Raspberries	1⅛ cups	0.18	
Potatoes	1 medium	0.166	0.019
Peanuts	2 dozen singles	0.16	
Carrots	3 to 4 medium	.....	0.168
Blackberries	1½ cups	.....	0.13
Strawberries	1⅓ cups	.....	0.13
Figs	1½ large	.....	0.089
Lemon juice	1 cup	.....	0.083
Beets	2 to 4 medium	.....	0.06
Peas, fresh	1 cup	.....	0.032
Raisins	¼ cup	.....	0.02
Prunes	4 to 5 prunes	.....	0.02

but this deficiency can be made up by adding cod liver oil to the diet or by exposure to the sun's rays. The phosphorus content of our food supply should not be treated lightly.

The teaching of health workers everywhere in educating parents to the full meaning of proper food for the baby and growing child is being constantly revised. It will be increasingly important that it emphasize not only food values but also the quality of the food consumed.

The effect of diet, apart from environmental factors on the gains of infants, has recently been indicated by the experiments of Daniels[1] and her co-workers at the Child Welfare Research Station of the State University of Iowa. Daniels reports that infants receiving cod liver oil as a supplement to modified cow's milk not only weighed more at the same age than those not so supplied, but were considerably heavier than the accepted standards for infants of their respective ages and birth weights. The unique components of the cod liver oil are, of course, vitamins A and D, hence the Iowa investigators ventured the conclusion that conditions which make for better utilization of calcium and phosphorus will result in larger and physically better developed children.

Table V, modified from Rose,[2] gives the amount of calcium and phosphorus in 100-calorie portions of some common food materials.

Iron.—The iron content of the human body is small, but its importance is very great. The loss of iron from the blood results in a condition known as anemia, also chlorosis. Sherman[3] sets as the desirable standard "15 mg. of food iron per man per day." Women during pregnancy and at the menstrual period would require more, perhaps about 18 mg. Table VI, from Rose,[4] gives the iron content in grams of food rich in iron.

Sherman sets 15 mg. of food iron per day as a minimum. The above portions give the iron content in grams. Fifteen mg. expressed in grams would be 0.015 Gm. It follows,

[1] Daniels, Amy L., and others: Growth in Infants from the Standpoint of Physical Measurements and Nitrogen Metabolism, *American Journal of Diseases of Children*, June, 1929.

[2] Rose, M. S.: Feeding the Family, The Macmillan Co., New York, 1919, pp. 22, 24, 25.

[3] Sherman, H. C.: *Loc. cit.*, p. 299.

[4] Rose, M. S.: *Loc. cit.*, p. 23.

therefore, that the minimum would be satisfied by providing adequate portions of the above.

In order to supply sufficient iron, foods should be selected with some consideration of the amounts of iron present. Iron is especially available in meat, milk, eggs, whole wheat flour, spinach, and beans. A diet containing green vegetables liberally, whole wheat bread, fruits, and some meat will supply sufficient iron.

TABLE VI

AMOUNTS OF IRON IN 100-CALORIE PORTIONS OF SOME COMMON FOOD MATERIALS

Food material.	Measures of portion.	Iron, grams.
Spinach	$2\frac{1}{2}$ cups (cooked)	0.0133
Beans, string	$2\frac{1}{4}$ cups 1-inch pieces	0.0038
Cabbage	5 cups (shredded)	0.0035
Beef, lean	$2\frac{1}{4}$ ounces (uncooked)	0.0032
Celery	4 cups $\frac{1}{4}$-inch pieces	0.0027
Egg yolk	2 yolks	0.0023
Strawberries	$1\frac{1}{3}$ cups	0.0023
Beans, dried	$\frac{1}{8}$ cup (uncooked)	0.0020
Eggs	$1\frac{1}{3}$ eggs	0.0019
Tomatoes	$1\frac{3}{4}$ cups (cooked)	0.0017
Carrots	3 to 4 medium	0.0016
Peas, dried	2 tablespoonfuls (uncooked)	0.0015
Potatoes	1 medium	0.0015
Beets	2 to 4 medium	0.0013
Turnips	2 cups $\frac{1}{2}$-inch cubes	0.0013
Bread, graham	2 slices	0.0013
Grapes	1 large bunch	0.0013
Onions	3 to 4 medium	0.0011
Raisins	$\frac{1}{4}$ cup	0.0010
Figs	$1\frac{1}{2}$ large	0.0010
Oatmeal	1 cup cooked	0.0009
Prunes	4 to 5 prunes	0.0009
Milk	$\frac{5}{8}$ cup	0.00034
Bread, white	2 slices	0.0003

"Does man need medicinal iron?" has often been asked. Numerous laboratory experiments extending since 1854 provides today the opinion that food will provide all that is needed of iron compounds for the body. It has been claimed that in anemia inorganic iron may act as a stimulus to the

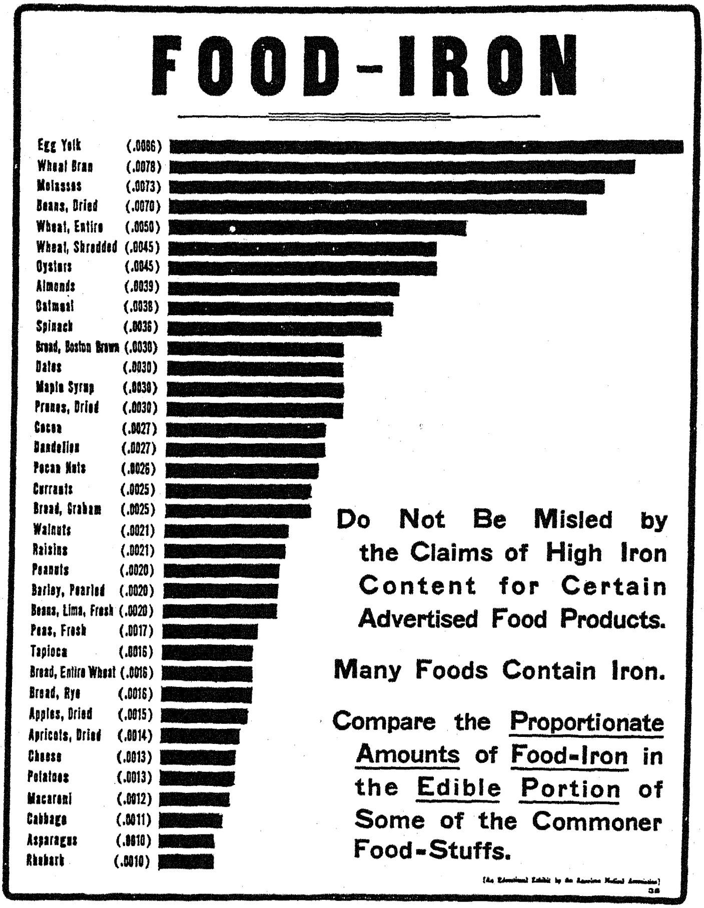

Fig. 89.—This table is based on the ash constituents of food in percentage of the edible portion. (By courtesy of the American Medical Association.)

body, but recent experiments by Whipple and Robscheit[1] do not indicate any such effects. The best medical opinion

[1] Whipple, G. H., and Robscheit, F. S.: Iron and Arsenic as Influencing Blood Regeneration, etc., *Archives of Internal Medicine*, May, 1921, vol. 27, p. 591.

holds that hemoglobin (the iron compound of the blood) is derived from the organic iron compounds of the food. The justification for patent medicine preparations of iron is lacking; intelligent and rational procedure in anemia and chlorosis[1] would be to provide adequate iron in the diet, to secure outdoor exercise, and remove any of the causes favoring the disease. The use of liver in the diet to effect a storage of iron in the blood has been shown to be effective even when the anemia is marked.

In "eat more" campaigns various foods are advertised and often with unwarranted enthusiasm. In this way raisins as purveyors of iron have achieved notice. It may be seriously questioned if one should eat large amounts of raisins because of the large amount of indigestible material they contain. The claim for iron content is an exceedingly brave one in view of the data in Table VI. (See also Fig. 89.) Thus $1\frac{1}{2}$ figs give as much as and one medium-sized potato gives more iron than $\frac{1}{4}$ cup of raisins. For health purposes $2\frac{1}{2}$ cups of milk or a half dozen prunes would be more desirable than raisins, no matter how attractive the box in which they were sold.

Iodine.—Of recent years another important mineral constituent of our food supply has been established. Following the important work of Kimball and Marine[2] in Ohio, numerous field and laboratory studies have been made demonstrating the relationship of the iodine content of drinking water and simple goiter. A survey by Olin[3] of four counties in Michigan established for this state the great differences in iodine content as shown on the following page.

[1] There is some evidence that medicinal iron is useful in chlorosis. But even here the management is more important than the medicine.

[2] Kimball, O. P.: The Prevention of Simple Goiter in Man, *The Nation's Health*, November 15, 1922, p. 656. Marine, D.: The Prevention of Goiter, Public Health, Michigan Department of Health, January, 1923. Marine, D., Lenhart, C. H., Kimball, O. P., and Rogoff, J. M.: Prevention of Simple Goiter, *Bulletin Western Reserve University*, July, 1923.

[3] Olin, R. M.: Iodine Deficiency and Prevalence of Simple Goiter in Michigan, *Journal American Medical Association*, April 24, 1926, pp. 1328–1332.

DIFFERENCES IN IODINE CONTENT OF WATER. IODINE CONTENT, PARTS PER BILLION

Macomb		*Midland*	
Mount Clemens	28.0	Midland	18.0
Mount Clemens	20.0	Midland	12.0
Mount Clemens Spring	3.0	Midland	11.6
Romeo	none	Midland	0.7
Richmond	0.3	Coleman	trace
Utica	1.0	Sanford	1.4
Average	8.7		7.3

Wexford		*Houghton*	
Cadillac	2.4	Houghton	none
Cadillac	0.8	Houghton Springs	none
Mesich	none	Doelle Agri. Cultural Sch.	none
Harrietta	none	Calumet	none
Manton	none	Chassel	none
Harlan	none	Hubell	none
		Lake Kinden	none
		South Range	none
Average	0.5		none

McClendon[1] examined 100 specimens of water from various sections of the United States, and concluded that the prevalence of simple goiter varies inversely with the amount of available iodine in the food supply of the region.

Guilder[2] reported 276 cases (45.3 per cent) of enlarged thyroid in an examination of 609 women students at the University of Illinois. The condition was found with greatest frequency in the youngest students, the highest percentage, 66.6, occurring at sixteen years of age. Of the 276 cases with enlarged thyroid, 199 had spent their childhood in Illinois.

The normal thyroid contains about 40 mg. of iodine. The minute traces of iodine in food and water suggest that the requirement for the body is small. The amount of iodine required by the body is 300 mg. a year. This may

[1] McClendon, J. F.: Simple Goiter as a Result of Iodine Deficiency (with assistance of Agnes Williams), *Journal American Medical Association*, March 3, 1923.

[2] Guilder, R. P.: Incidence of Goiter in College Students (Women), *Annals of Clinical Medicine*, Baltimore, January, 1923.

be provided by administering sodium iodide in areas where the iodine content of food supplies is low. Rochester (and other cities) is attempting to solve its goiter problem by putting iodine in the public water supply. The salt manufacturers of Michigan[1] have put on the market an iodized table salt containing 0.02 of 1 per cent of sodium iodide. Although the body requires very little iodine, the fact that it *does* require some is an illustration of the now well-founded dictum of the importance of little things in the diet.

The amount of iodine in food varies in localities. Generally milk, leafy vegetables, and fruits afford the larger amounts. The bony fish are rather low in iodine compared with other sea foods. Kelp is extremely rich in iodine. Table VII by McClendon[2] shows the iodine content of certain foods in nongoitrous and goitrous areas.

The Mineral Salts and Body Reaction.—The blood and body fluids show alkaline to litmus, but the hydroxyl ions are not appreciably in excess of the hydrogen ions, and for practical purposes they may be called neutral. The normal metabolic changes in growth and action produce acids which must be neutralized in order to keep the blood and body fluids in the proper condition. The source of the power to develop neutrality lies in the food of the diet and especially in the carbonates, phosphates, ammonia, and proteins. Sherman,[3] in speaking of the experiments of Blatherwick, says, ". . . foods which have a preponderance of base-forming elements lead to the formation of a urine which is less acid, both as regards hydrogen ion concentration and titration acidity, while the ammonia content of the urine is diminished and the carbon dioxide tension of the alveolar air, indicative of reserve alkalinity, is increased."

The foods containing base-forming elements are chiefly milk, vegetables, and fruits. It has been previously noted

[1] Olin, R. M.: Thyroid Enlargement in Michigan, *Child Health Magazine*, July, 1924.

[2] McClendon, J. F.: Inverse Relation between Iodine in Food and Drink and Goiter, Simple and Exophthalmic, *Journal American Medical Association*, May 24, 1924, p. 1668.

[3] Sherman, H. C.: *Loc. cit.*, p. 281.

TABLE VII

MILLIGRAMS OF IODINE PER METRIC TON OF DRY FOODSTUFFS

From Nongoitrous Regions

	Iodine content.	Locality.
Wheat	4.0	Storrs, Conn.
Wheat	9.3	Edgecomb, Me.
Oats	23.0	Storrs, Conn.
Oats	175.0	Wiscosset, Me.
Corn	52.0	Wiscosset, Me.
Barley	73.0	Storrs, Conn.
Rye	3.5	Storrs, Conn.
Carrots	170.0	California coast
Salmon	45.0	Alaska
Salmon	75.0	Oregon
Salmon	115.0	Alaska
Salmon	324.0	Alaska
Goats' milk	400.0	California coast (Salina)

From Goitrous Regions

	Iodine content.	Locality.
Cereals:		
Oats	10.0	Minnesota
Wheat	1.0	Minnesota
Wheat	6.6	Minnesota
Straight flour	3.5	Minnesota
Bran	15.5	Minnesota
Shorts	9.6	Minnesota
Red Dog	3.7	Minnesota
Pot Herbs:		
Spinach	19.5	Oregon
String beans	29.0	Oregon
Carrots	2.3	Oregon
Soup vegetables	13.5	Oregon
Fruits:		
Apples (pared and cored)	3.0	Oregon
Pears (pared and cored)	15.0	Oregon
Prunes	4.8	Oregon
Bing cherries	33.0	Oregon
Peaches	11.1	Oregon
Loganberries	160.0	Oregon
Animal foods:		
Skimmed milk	12.0	Minnesota
Butter	140.0	Minnesota

that these foods are also valuable, especially for their salts of calcium and iron, and for their vitamins.

What Common Foods Give.—The common foods of man serve different functions. These may be grouped as follows:

Breadstuffs.—These include the grains (cereals, rice, etc.) and things made from grains (bread, pastry, etc.). They are

economical sources of energy and protein but are unsatisfactory in furnishing minerals and vitamins.

Sugars and Fats.—These include the starches. These are the chief sources of heat. Their worth is mainly expressed in calories. Some fats yield vitamins A and D. Thus, butter and cream are very important and should be included in the diet.

Meats.—These include fish and poultry. As a group, they are rich in protein. Some contain much fat as pork and some fish. Meats are a poor source of vitamins and often without value as a source of mineral. Amount of iron in meat varies greatly.

Fruits and Vegetables.—These are the best source of vitamins D and C, and extremely valuable for minerals.

Milk.—This food supplements well the deficiencies of grains. The vitamin content of milk depends upon the vitamin content of the diet of the cow. Milk more than any other food may be called a complete food. Butter and cream are rich in calories and vitamin A.

Eggs.—Egg yolk is an excellent source of vitamin D; it contains considerable fat. The white of egg is protein.

The Hygiene of Nutrition.—By voluntary act it is quite impossible to control intestinal peristalsis, to direct the flow of bile, or to favor the absorption of digested food elements from the alimentary canal. The hygiene of nutrition, however, is not dependent upon such control. All that is essential in the nourishment of the body and in the economy of processes relates to factors that are controllable. They are: to choose food wisely; to eat correctly, and to evacuate regularly.

Wise Choice of Food.—Choosing food wisely involves a knowledge of the functions of food, its power to build tissue, to yield energy, and to regulate body processes. In addition, food values in terms of calories and with reference to man's needs, food digestibility, and food poisons are important matters to consider in the choice of food. The functions of food have been presented. There remain the caloric values and the body's need, food digestibility, and idiosyncrasies of people toward different foods.

(*a*) *Food Values and Body Needs.*—Lusk[1] says, "One can say that in the United States there is no protein, or salt or vitamin deficiency in the habitual diet, and there is plenty of roughage in the form of cabbage, sauerkraut, and other vegetable foods available to him who desires it." Sherman,[2] however, in analyzing 150 American dietaries, says with reference to the iron content, "Apparently, therefore, the typical American dietary does not contain any such surplus of iron as would justify the practice of leaving the supply of this element entirely to chance."

Experts differ on these points. The rational procedure in such a situation is for the individual with adequate knowledge to make sure that the best available is selected. This means frequently not eating more food, but choosing wisely less food. For although the past tendency has been to set standards for diets, it should be noted that it is quite impossible to plan a single diet that will be adequate for all. At best certain principles may be stated:

The protein and energy factors of the diet should be modified in accordance with the needs of the organism as regards growth, work, and body weight. Thus Atwater[3] recommends:

Standards for	Protein, grams.	Fuel values, calories.
Man at hard muscular work	150	4150
Man at moderately active muscular work	125	3400
Man at sedentary or woman with moderately active work	100	2700
Man without muscular exercise or woman at light moderate work	90	2450

While European experts place the protein requirement higher, the tendency of chemists in America has been to

[1] Lusk, G.: *Journal American Medical Association*, June 22, 1915, p. 171.

[2] Sherman, H. C.: *Loc. cit.*, p. 303.

[3] Atwater: United States Department of Agriculture, Farmers Bulletin No. 142, 15th Annual Report Agricultural Experiment Station, Storrs, Connecticut, 1903.

constantly set a lower standard. Chittenden in particular has set the standard much lower, and holds that 50 Gm. a day is sufficient for body needs. From a survey of numerous experiments Sherman[1] reports, "the apparent protein requirements as indicated by the data of individual experiments ranges between the extremes of 20 and 79.2 Gm., averaging 49.2 Gm. of protein per man of 70 Kg. per day. Thus the average falls well within the range of Chittenden's estimate" (see Lusk's report on German diets, p. 231). Sherman[2] found that nitrogen equilibrium was maintained with protein of 35 to 45 Gm. from cereal grains. Providing a margin of safety, 70 to 80 Gm. of protein would seem adequate.

The energy requirements are related to the work of the body. To maintain the body weight the fuel value of the food must be sufficient for the needs of the body. If fat is deposited, more fuel has been taken in than can be burned; hence the excess is stored. Fuel value of children's dietaries should always be liberal to provide for great muscular activity and marked growth. Sherman[3] gives the energy requirements of different ages as follows:

Under 1 year	45 calories per pound	(about 900 calories)
1– 2 years	45–40 calories per pound	(about 1000–1100 calories)
2– 5 years	40–36 calories per pound	(about 1100–1500 calories)
6– 9 years	36–32 calories per pound	(about 1600–1900 calories)
10–13 years	34–27 calories per pound	(about 2000–2700 calories)
14–17 years	30–32 calories per pound	(about 2500–3400 calories)
18–25 years	25–18 calories per pound	(about 3400–3800 calories)
30 years	2750 calories for man of 152 pounds	
40 years	2500 calories for man of 154 pounds	
60 years	2300 calories for man of 150 pounds	
70 years	2000 calories for man of 134 pounds	
80 years	1750 calories for man of 139 pounds	

The above figures indicate that during the period of growth a great increase in fuel is necessary; that a young person, fourteen to seventeen years, may need more fuel than one thirty years of age; and that as age increases the

[1] Sherman, H. C.: *Loc. cit.*, p. 220.
[2] Sherman, H. C.: Proceedings National Academy of Sciences, January, 1920, pp. 38–40.
[3] Sherman, H. C.: *Loc. cit.*, p. 196.

fuel requirement decreases. Age is not a valuable indication alone. Work done with reference to age is the best guide. The "man of the house" living a sedentary life may require less than the young boy only twelve years of age.

It will thus be seen that while it is possible to calculate from tables the caloric value of the diet for different individuals, it is unsafe to set absolute standards. In addition to caloric needs the child should correspond in weight with the members of the age-height group in which he falls; the adult should adjust diet to weight and also to work. The danger of the child being malnourished and of the adult being too well nourished is so important that tables (Table VIII) are given to indicate what the weight should be for different individuals. These tables are based on averages and will not meet the needs for all even with the range provided in the age columns.

Pickert in Hamburg has undertaken to study the caloric needs of a large group of men whose working performance and nutrition could be accurately regulated and observed. He used a group of policemen in training and reached the following results: The group of 24 men averaging twenty-six years of age, during a thirty-two days' course of full training, received about 4300 calories, about 2300 calories of which were used up in basal metabolism, food action and energy exchange. It was found that a mixed diet with regular side dishes of fresh vegetables, salads and the like is the most satisfactory. That these quantities of food are amply sufficient was shown by the gain in weight, by a gradual increase in performance over a long period of time, and by the excellent health conditions prevailing in the group.

(b) *Food Digestibility.*—It is not possible to be guided in the choice of food only by the caloric yield any more than by its salt or vitamin content. All the factors are important. Thus certain foods are easy and others difficult to digest; while for some persons foods may be entirely unsuited, and to others entirely unwholesome. This problem of feeding the human being is one that requires care, attention, and reasonable intelligence.

TABLE VIII

HEIGHT AND WEIGHT TABLES

BOYS

Height Inches	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs	10 Yrs	11 Yrs.	12 Yrs.	13 Yrs.	14 Yrs.	15 Yrs.	16 Yrs.	17 Yrs.	18 Yrs.
39	35	36	37											
40	37	38	39											
41	39	40	41											
42	41	42	43	44										
43	43	44	45	46										
44	45	46	46	47										
45	47	47	48	48	49									
46	48	49	50	50	51									
47	....	51	52	52	53	54								
48	....	53	54	55	55	56	57							
49	....	55	56	57	58	58	59							
50	....	....	58	59	60	60	61	62						
51	....	....	60	61	62	63	64	65						
52	....	....	62	63	64	65	67	68						
53	....	....	....	66	67	68	69	70	71					
54	....	....	....	69	70	71	72	73	74					
55	....	....	....	....	73	74	75	76	77	78				
56	....	....	....	....	77	78	79	80	81	82				
57	....	....	....	....	....	81	82	83	84	85	86			
58	....	....	....	....	....	84	85	86	87	88	90	91		
59	....	....	....	....	....	87	88	89	90	92	94	96	97	
60	....	....	....	....	....	91	92	93	94	97	99	101	102	
61	....	....	....	....	....	....	95	97	99	102	104	106	108	110
62	....	....	....	....	....	....	100	102	104	106	109	111	113	116
63	....	....	....	....	....	....	105	107	109	111	114	115	117	119
64	....	....	....	....	....	....	......	113	115	117	118	119	120	122
65	....	....	....	....	....	....	......	......	120	122	123	124	125	126
66	....	....	....	....	....	....	......	......	125	126	127	128	129	130
67	....	....	....	....	....	....	......	......	130	131	132	133	134	135
68	....	....	....	....	....	....	......	......	134	135	136	137	138	139
69	....	....	....	....	....	....	......	......	138	139	140	141	142	143
70	....	....	....	....	....	....	......	......	......	142	144	145	146	147
71	....	....	....	....	....	....	......	......	......	147	149	150	151	152
72	....	....	....	....	....	....	......	......	......	152	154	155	156	157

MEN

Height	19 Yrs.	20 Yrs.	21-22 Yrs.	23-24 Yrs.	25-29 Yrs.	30-34 Yrs.	35-39 Yrs.	40-44 Yrs.	45-49 Yrs.	50-54 Yrs.	55-59 Yrs.
5 ft..........	107	110	114	118	122	126	128	131	133	134	135
5 ft. 1 in.....	112	115	118	121	124	128	130	133	135	136	137
5 ft. 2 in.....	117	120	122	124	126	130	132	135	137	138	139
5 ft. 3 in.....	121	124	126	128	129	133	135	138	140	141	142
5 ft. 4 in.....	124	127	129	131	133	136	138	141	143	144	145
5 ft. 5 in.....	128	130	132	134	137	140	142	145	147	148	149
5 ft. 6 in.....	132	133	136	138	141	144	146	149	151	152	153
5 ft. 7 in.....	136	137	140	142	145	148	150	153	155	156	158
5 ft. 8 in.....	140	141	143	146	149	152	155	158	160	161	163
5 ft. 9 in.....	144	145	147	150	153	156	160	163	165	166	168
5 ft. 10 in.....	148	149	151	154	157	161	165	168	170	171	173
5 ft. 11 in.....	153	154	156	159	162	166	170	174	176	177	178
6 ft..........	158	160	162	165	167	172	176	180	182	183	184
6 ft. 1 in.....	163	165	167	170	173	178	182	186	188	190	191
6 ft. 2 in.....	168	170	173	176	179	184	189	193	195	197	198
6 ft. 3 in.....	173	175	178	181	184	190	195	200	202	204	205
6 ft. 4 in.....	178	180	183	186	189	196	201	206	209	211	212
6 ft. 5 in.....	183	185	188	191	194	201	207	212	215	217	219

TABLE VIII

HEIGHT AND WEIGHT TABLES

GIRLS

Height Inches	5 Yrs	6 Yrs	7 Yrs	8 Yrs	9 Yrs	10 Yrs	11 Yrs.	12 Yrs.	13 Yrs.	14 Yrs.	15 Yrs.	16 Yrs.	17 Yrs.	18 Yrs.
39	34	35	36											
40	36	37	38											
41	38	39	40											
42	40	41	42	43										
43	42	42	43	44										
44	44	45	45	46										
45	46	47	47	48	49									
46	48	48	49	50	51									
47	....	49	50	51	52	53								
48	....	51	52	53	54	55	56							
49	....	53	54	55	56	57	58							
50	....	....	56	57	58	59	60	61						
51	....	....	59	60	61	62	63	64						
52	....	....	62	63	64	65	66	67						
53	....	....	....	66	67	68	68	69	70					
54	....	....	....	68	69	70	71	72	73					
55	....	....	....	....	72	73	74	75	76	77				
56	....	....	....	....	76	77	78	79	80	81				
57	....	....	....	....	....	81	82	83	84	85	86			
58	....	....	....	....	....	85	86	87	88	89	90	91		
59	....	....	....	....	....	89	90	91	93	94	95	96	98	
60	....	....	....	....	....	....	94	95	97	99	100	102	104	106
61	....	....	....	....	....	....	99	101	102	104	106	108	109	111
62	....	....	....	....	....	....	104	106	107	109	111	113	114	115
63	....	....	....	....	....	....	109	111	112	113	115	117	118	119
64	....	....	....	....	....	....	......	115	117	118	119	120	121	122
65	....	....	....	....	....	....	......	117	119	120	122	123	124	125
66	....	....	....	....	....	....	......	119	121	122	124	126	127	128
67	....	....	....	....	....	....	......	......	124	126	127	128	129	130
68	....	....	....	....	....	....	......	......	126	128	130	132	133	134
69	....	....	....	....	....	....	......	......	129	131	133	135	136	137
70	....	....	....	....	....	....	......	......	......	134	136	138	139	140
71	....	....	....	....	....	....	......	......	......	138	140	142	143	144
72	....	....	....	....	....	....	......	......	......	......	145	147	148	149

WOMEN

Height	19 Yrs.	20 Yrs.	21-22 Yrs.	23-24 Yrs.	25-29 Yrs.	30-34 Yrs.	35-39 Yrs.	40-44 Yrs.	45-49 Yrs.	50-54 Yrs.	Yrs.
4 ft. 10 in.....	98	102	106	110	113	116	119	123	126	129	......
4 ft. 11 in.....	103	107	109	112	115	118	121	125	128	131	......
5 ft...........	109	112	113	115	117	120	123	127	130	133	......
5 ft. 1 in.....	113	115	116	118	119	122	125	129	132	135	......
5 ft. 2 in.....	116	118	119	120	121	124	127	132	135	138	......
5 ft. 3 in.....	120	121	122	123	124	127	130	135	138	141	......
5 ft. 4 in.....	123	124	125	126	128	131	134	138	141	144	......
5 ft. 5 in.....	126	127	128	129	131	134	138	142	145	148	......
5 ft. 6 in.....	129	130	131	133	135	138	142	146	149	152	......
5 ft. 7 in.....	131	133	135	137	139	142	146	150	153	156	......
5 ft. 8 in.....	135	137	139	141	143	146	150	154	157	161	......
5 ft. 9 in.....	138	140	142	145	147	150	154	158	161	165	......
5 ft. 10 in.....	141	143	145	148	151	154	157	161	164	169	......
5 ft. 11 in.....	145	147	149	151	154	157	160	164	168	173	......
6 ft...........	150	152	154	156	158	161	163	167	171	176	......

The digestibility of foods has been expressed in terms of coefficients of digestibility, by which is indicated the percentage of the food available for men as determined by the relation between the constituents of the food consumed and the corresponding constituent of the waste material from the alimentary tract. Atwater has computed the coefficients of digestibility of the main classes of food on a simple mixed diet as follows:

PERCENTAGE DIGESTIBILITY OF FOOD

Food.	Protein, per cent.	Fat, per cent.	Carbohydrates, per cent.
Animal foods	97	95	98
Cereals and breadstuffs	85	90	98
Dried legumes	78	90	97
Vegetables	83	90	95
Fruits	85	90	90
Total of average mixed diet	92	95	98

Digestibility of food should not be confused with ease of digestion nor rapidity of digestion. Food that stays a long time in the stomach is said to be difficult of digestion, but this refers only to rate of digestion and not to the yield of the food elements finally. There seems to be little relation between ease or rapidity of digestion and the percentage or coefficient of digestibility of food. There is a difference, however, in foods as regards the length of time given to gastric digestion. Sherman[1] states the following concerning the movement of food materials through the stomach:

"Ordinarily, when each is fed separately, protein food stays longer in the stomach than carbohydrate, fat longer than protein, and mixtures of fat and protein leave the stomach more slowly than either alone. This is probably because fat tends to retard both the motility of the stomach and the secretion of the acid gastric juice. In general, the softer or more fluid the fat, the more rapidly it will leave the stomach; also emulsified fats tend to pass no more promptly than fat of the same kind taken in larger masses."

[1] Sherman, H. C.: *Loc. cit.*, p. 87.

Hawk[1] and his associates have conducted a series of experiments on gastric digestion. Some of the conclusions of this work are given below:

Whole boiled, creamed, mashed (with and without milk and butter), baked (with and without butter), French, German and plain fried potatoes, potato salad, and potato chips "left the stomach in moderate time or one and a half to two and a half hours for rapid type individuals and two to three and a half hours for the slow type. Fried potatoes left the stomach as rapidly as potatoes prepared in other ways. Sweet potatoes remained longer in the stomach than white potatoes cooked in the same ways."

Pickled red beets left the stomach more rapidly than boiled red beets, although the latter left in one or two hours. Carrots, parsnips, and turnips, boiled, left the stomach in one and a half to three hours.

"In general, raw vegetables low in protein, as carrots, celery, tomatoes, cabbage, lettuce, and cucumber, leave the stomach rapidly—and without great change."

In studying the effect of water, tea, coffee, and cocoa upon digestion in the stomach the following conclusions were made by Hawk[2] and his associates:

"Evacuation of the stomach was not appreciably delayed by the drinking of 1 liter of cold water, cold or hot tea, hot coffee, either plain, with cream, or cream and sugar. The addition of sugar alone to coffee delayed evacuation.

"Cocoa in 1 liter quantities markedly delayed evacuation."

Results from the study[3] of candies show: "Candies depress secretion and delay evacuation in proportion to their sugar content and the amount of them ingested. This tendency is influenced, however, by flavoring substances, and particularly by added food ingredients, such as milk, eggs, or chocolate, which stimulate gastric secretion. Candies should be eaten not before but after meals. Hard candies

[1] Hawk, P. B., and associates: The Gastric Response to Foods, *American Journal of Physiology,* vol. 51, No. 2, March 1, 1920, pp. 332–349.

[2] Hawk, P. B., and associates: *Loc. cit.*, vol. 52, No. 1, May, 1920, pp. 28–53.

[3] *Ibid.*, vol. 53, No. 1, August, 1921, pp. 65–88.

which must be sucked are preferable to cream candies for children."

A study of the digestion in the stomach of puddings, pies, and cakes gives an average time for puddings of two hours; pies, two hours and twenty-four minutes; cakes, three hours. Pies were digested more rapidly than cakes. "The addition of 50 Gm. of ice cream to a small piece of pie did not increase the burden of the stomach to any marked extent."

Recent studies at the University of Chicago[1] support Hawk's observations regarding fried foods. For the ordinary person fried potatoes are as easy to digest as boiled potatoes. It is the *amount* of fat present in any food that delays digestion and not the form of preparation employed.

(*c*) *Food Poisons.*—Food that is for others entirely wholesome becomes for some persons a distinct poison. That means that those persons have an idiosyncrasy for that particular food. Many people develop fads and fears as regards certain foods, but a real food idiosyncrasy may exist. Individuals may show intolerance for even the most wholesome food. Some children have an idiosyncrasy toward eggs, milk, and other animal proteins. Such reaction to food is called sensitization. Sensitization to certain proteins is the most usual form observed.

It is not so easy to explain the way in which sensitization to food occurs, but the fact of sensitization is well known.[2] Supposedly, the child is given too much of a new food, which he has not as yet developed a capacity to handle. There results a susceptibility which renders the individual unable to care for that kind of food subsequently. The phenomenon of sensitization is also known to exist in certain disturbances of the respiratory tract, *e. g.*, certain forms of hay fever are known to be related to definite flower or vegetable proteins.

In medicine it is known that foreign proteins injected into the blood may render the individual very sensitive to

[1] Boggess, B., and Ivy, A. C.: The Digestibility of Potatoes as Influenced by Methods of Preparation, *Journal of Home Economics*, September, 1927, p. 496.

[2] Longcope, W. T.: Protein Hypersensitiveness, *Journal American Medical Association*, November 12, 1921, p. 1535.

the particular protein injected. This sometimes occurs in the administration of antitoxin.

Correct Eating.—The eating of food has become today a complex matter. It is not sufficient to provide for proper energy needs, vitamins, and salts; to eat in such fashion that digestion will be as thorough, rapid, and orderly as possible is very desirable. It is, therefore, important to note those conditions that are associated with the hygiene of eating.

1. Environment.

The quiet, clean, attractive dining place is a boon to good eating. To avoid noisy, dirty places should be the first thought in selecting a place to eat. The dining-room should tend to produce repose, quiet, freedom from hurry and rush. It is an expression of an overwrought nervous system to desire an eating place where the din of jazz rhythms vies with the screeching voices to be heard above the rattle and crashing of dishes and cabaret singers. Digestion is aided by an atmosphere of quiet and calm.

In a study of the psychic influences on digestion of food, Hawk[1] and his associates found as follows: "Mixed meals consisting of nourishing ingredients, but very unpleasantly prepared and served, gave rise in the case of a phlegmatic individual to no distinct delay, . . . a more susceptible individual showed a slight delay.

"Chinese preserved eggs, unpalatable to our subjects in appearance, odor, taste, and belief in their unwholesome character led to delayed acid response and evacuation."

2. Condition of the individual.

One should come to the table rested. If fatiguing work has been performed before mealtime, the hygienic plan would provide a period of rest before eating.

Moreover, the mind and spirits of the individual should be cheerful and happy. Hawk reports that

[1] Hawk, P. B., and associates: Gastric Response to Foods, *American Journal of Physiology*, vol. 52, No. 1, May, 1920, pp. 1–11.

anxiety and mental strain markedly delay gastric digestion. The importance of avoiding emotional states associated with worry is nowhere more pronounced than in connection with this subject. If depressing emotional conditions do control, it is best not to eat at that time. One should replace such states with a brave, cheerful attitude and the digestive tract will be ready to do its work. Nervous indigestion is a symptom of bad mental hygiene.

3. The technic of eating.

If one comes to a dining-room that is quiet and attractive, and is himself free from fatigue and from depressing emotional states, one might eat almost any food in usual amounts, either rapidly or slowly, without experiencing any difficulty in digestion. All may not be so indiscreet, however. Nor is it wise for any one to so indulge his gastronomic instincts. Reason must guide here. The secret in eating then, is:

1. To eat slowly. It has been claimed that we should chew each morsel of food thirty times. It is surely a waste of energy to count our jaw movements and unwise to concentrate our attention too much on the process of eating. Food should be enjoyed. The environment free from rush and hurry will help us automatically to chew food more—to eat slowly.
2. Not to wash food down the esophagus with drink. If the food is well chewed this will not be necessary. It is not unhygienic to drink water at mealtimes if no food is in the mouth at the time of drinking. Ice-water should not be used. Milk that is cold should be drunk very slowly.

   Hawk found that cold water did not appreciably delay digestion if taken during the meal. The practice of drinking cold water at the beginning is to be condemned. Many people coming to the table hungry and thirsty commit a hygienic sin here. The blood vessels of the stomach are dilated and the blood supply is abundant; the

gastric glands are exceedingly active in preparation for the food about to be eaten—when suddenly a dash of cold water is thrown into the stomach, constricting the vessels and checking secretion. One should always eat some warm food before drinking cold water at meals.

3. Do not overeat. To stop before completely satisfied is good dietary advice. This means often foregoing the attractive dessert, or omitting the second helping of the favorite dish. A good plan is to take very small helpings. Eating slowly will help to eat less; one is satisfied with less when that taken is chewed thoroughly.

Regular Evacuation.—The hygiene of nutrition has been grouped around the wise choice of food, correct eating, and regular evacuation of the bowels, because all these factors are closely related. The best food correctly eaten will not nourish if waste material is not removed. Here is indicated the essential interdependence between all parts of the body. No one part can live to itself alone. All must function properly. Loss of efficiency in one part affects all. More will be said upon this subject in Chapter X; it is enough at this time to indicate its importance and connection.

Causes of Indigestion.—Frequently indigestion occurs because food is improperly cooked, but, as indicated above, there are other factors. These may be grouped together as the causes of indigestion:

1. Improper foods. This may refer to the choice of the food or to the combination chosen.
2. Improper cooking of the food. Food to be cooked should be cooked thoroughly, especially vegetables, breads, and pastries. It should be remembered that some vegetables are rendered more digestible with short rather than with long periods of cooking.
3. Food idiosyncrasies. Examples are oysters, shellfish, fish, buckwheat cakes, strawberries, and chocolate.
4. Physical fatigue. If tired, one should rest before eating or eat very lightly (better not eat at all).
5. Worry and depressing emotional states.

6. Rapid eating. Important to avoid places that are noisy. Freedom from a sense of hurry is essential to correct eating.
7. Drinking cold water before eating warm food at mealtime.
8. Overeating. Large amounts of food may affect only slightly the coefficient of digestibility, but they do retard the ease and rapidity of digestion. Snyder found, however, that protein was 7 per cent and fat 6 per cent more completely absorbed in medium amounts of oatmeal and milk when he compared medium and large amounts of this ration.
9. Constipation. Lack of evacuation of the bowels is frequently a cause of improper digestion of food.
10. Defective teeth. This cause may act by not permitting thorough mastication; it also may be effective through the disturbance of the condition of the stomach due to the presence of pus material from the teeth.[1]
11. Various diseases. Indigestion may be a sign of appendicitis. When the indigestion is prolonged it may be a sign of gastric ulcer, and in an elderly person, of cancer of the stomach.

Fads and Fallacies in Diet.—The individual who chooses food thoughtfully and on a logical plan needs all the facts available. Most food fads represent partial truths. They are so usual and commonplace that to account for their occurrence would be to write the story of human superstition. Several of the most common will be discussed.

Vegetarianism.—At times extremists of this fad take a position of protest against the eating of animal flesh because of a philosophy that is opposed to the taking of animal life. In this position they may be accused of sentimentalism. If their philosophic and biological education were as comprehensive as it should be to decide a question of this kind they would appreciate the common origin of plant and animal life,

[1] It has not been determined whether the gastric disturbance results from the swallowing of pus or from infection through the circulation, or from both.

and the essential integrity of the *l'elan vital* of Bergson, in both animals and plants. However, they must live, and since sentimentality often succumbs to the inconsistencies that science avoids, they continue to choose eggs, milk, and cheese to supplement their vegetarian diet of nuts, cereals, and vegetables.

Those who take the vegetarian rôle because of a belief in the superior value of a nonmeat diet have many arguments that are interesting and worth investigating. Some members of this group object to eating lamb, beef, or pork because they believe that such foods are not wholesome. Some say that all animals are diseased, that many sick animals are killed for food, that serious disease often follows eating animal food. These are partial statements and half truths, that acquire a standing quite beyond their value. Some flesh is unwholesome (*e. g.*, trichinosis is a serious disease at times); meat inspection should rule out the killing of sick animals just as it should eliminate rotten fruit and vegetables from the markets. In general, it is effective.

The question of the relative superiority of animal or vegetable protein needs scientific information. The following facts have been established by investigations and experience:

1. The protein of animal food is more completely utilized by the body than the protein of fruits, vegetables, dried legumes, cereals, or breadstuffs. The coefficient of digestibility for animal food is 97 per cent; for the vegetarian group it varies from 78 to 85 per cent. This difference is 12 to 19 per cent. If one requires 100 Gm. of protein daily, it is necessary to eat from 112 to 119 Gm. of vegetarian protein to secure the same amount that is available from 100 Gm. of animal food.
2. The body needs animal protein. This may be largely supplied from milk and eggs.
3. The superior palatability of meat proteins is generally recognized.
4. Racial superiority may be definitely related to food habits. It may be suggested that this has some

influence in the development to dominant positions in the world of those races that are meat eating as contrasted with the vegetarian groups. Sherman, however, refers to these races as "not meat-eating but cow-keeping races."

5. It should be noted, however, that it is a mistake to eat too much meat. The limit has been placed at "meat once a day only." This may be an excessive limitation, however, in view of Stefansson's experience. Nevertheless, excessive eating of meat leaves a waste of protein that is not only economically bad but also undesirable because of the strain upon kidneys[1] which must remove the end-products of protein metabolism. The purines are more abundant in meat.

6. Pork is the least desirable of all meat. It is difficult to digest. It should always be thoroughly cooked to kill the trichina, if perchance the parasite is present. Beef is valuable for its iron content as well as protein. Lamb is tasty and easily digested. Fowl and fish are very desirable forms of flesh food. Lobster and scallops are quite difficult to digest because of the toughness of the muscle.

There are probably few strict vegetarians. In reality, those who pose as such are "no meat" advocates. They eat animal foods, such as milk, cheese, and butter; otherwise they could not stay well.

Hot Water Fad.—This fad is especially vicious. Hot water before breakfast is helpful as a therapeutic measure for some persons, but its general use for all is not indicated. The ease with which people accept vague but rather plausible proposals for water therapy speaks vehemently of the sort of instruction given in physiology in the schools. Internal bathing by a patented cascade, hot water before meals,

[1] Recent evidence of the influence of high protein diet on kidney irritation is given by Squier, T. L., and Newburgh, L. H.: Renal Irritation in Man from High Protein Diet, *Archives of Internal Medicine*, July, 1921.

"water internally, externally, eternally"—these are but catch phrases of a fad that is unscientific and pernicious.

Raw Food Fad.—The raw food fad has some justification. Some vegetables are more wholesome uncooked and recent studies have shown that prolonged cooking of cabbage, corn, and string beans renders them less palatable also. For example, raw cabbage or cabbage boiled for eight minutes is more easily cared for in the stomach than cabbage cooked for an hour.

It has been generally held that fried foods are difficult to digest, but Hawk found no appreciable difference in time for digestion of fried potatoes as compared with potatoes cooked in other ways. In general, fat stays a long time in the stomach. If the food is fried in deep fat or prevented by other methods from taking up much fat, fried food is just as wholesome as other kinds.

There is a real health danger, especially from typhoid fever, in eating certain uncooked foods (*e. g.*, lettuce, celery, and water-cress) that have been grown in soil contaminated with sewage. Such uncooked food should be washed carefully in many changes of water, because the source is not usually known.

No-breakfast Fad.—It is not uncommon to find young people, especially girls, developing the no-breakfast fad. It should be stated that the body needs food in the morning to be drawn on for energy used in the day's activities. The body needs are often cared for by these individuals in two large meals. This is unwholesome, and it is more desirable to distribute food eaten over three meals rather than two. These individuals often show an aversion to milk and eggs. It should be remembered that they may like custards, creamed soups, oyster milk stews, eggnogs, and other food dishes in which milk and eggs are used. An egg is an egg, whether in a custard or in a chicken house; it will serve the nutritive needs of the body, so far as we know, as well in custard form as it will when boiled, or poached, or scrambled. The same can be said for milk.

In dieting programs which eliminate breakfast but include one large meal, the stimulating effect of food should be

reckoned. Richardson and Mason[1] were able to reduce the stimulating effect of food to as low as 2.6 per cent by giving small meals at frequent intervals thus supplying the foodstuffs needed by the cells at the rate at which they were being metabolized.

Sour Milk Fad.—The use of sour milk as a food was very popular some years ago due to the values assigned by Metchnikoff[2] to the change of the bacterial flora of the intestine produced by sour milk. This procedure has been very useful in the treatment of certain cases of intestinal intoxication, but as a guide for the normal person it offers nothing. Sour milk as a food is useful because it has the same constituents as sweet milk.

"Dieting."—As fashions change people wish to alter not only their clothes but their bodies also. For the past few years, it has been fashionable to be slender. In accordance with this motive many women have restricted their diets, purchased various and sundry reducing preparations, and even engaged in prayer for fat removal.

With some young women the weight reduction has been so severe that the onset of tuberculosis has been favored; with others the absence of vitamin A due to exclusion of butter fat has resulted in various skin disturbances. While many adults consume excessive amounts of food, irrational dieting is dangerous and should be replaced by the practice of selecting food in accordance with the needs of the body. "Dieting" may be carried over into various periods of fasting. The notion that fasting by healthy persons will increase resistance to disease is without foundation.[3] The ills of overeating and the dangers of undereating are always relative. That extremes are to be avoided is the simplest matter of common sense.

Moreover, fasting is not merely a matter of a decrease in calories. One might to advantage reduce the caloric intake

[1] Richardson, H. B., and Mason, E. H.: The Effect of Fasting in Diabetes as Compared with a Diet Designed to Replace the Foodstuffs Oxidized During a Fast, *Journal of Biological Chemistry*, 1923, 57, 587.

[2] Metchnikoff, E.: The Prolongation of Life, G. P. Putnam's Sons, New York, 1908.

[3] Spriggs, E.: *Lancet*, March 9, 1929.

but the more important item is that an insufficient diet means a deficiency in substances that exert a widespread influence on the whole organism. Needed vitamins and essential mineral salts are often cut out by injudicious fasting. The appalling effects in the central empires during the World War emphasize the danger of fasting.

Food Adulteration.—Before the passage of the Pure Food and Drug Act about 50 per cent of the food sold in the United States was adulterated. The act defines foodstuffs to be adulterated:

1. If any substance has been packed or mixed with it to reduce or lower or injuriously affect its quality or strength.
2. If any substance has been substituted wholly or in part for the article.
3. If any valuable constituent of the article has been wholly or in part abstracted.
4. If it is mixed, colored, powdered, coated, or stained in any manner whereby damage or inferiority is concealed.
5. If it contains any poisonous or other added deleterious ingredient which may render such article injurious to health.
6. If it consists in whole or in part of a filthy, decomposed, or putrid animal or vegetable substance or any portion of an animal unfit for food, whether manufactured or not, or if it is the product of a diseased animal or one that has died otherwise than by slaughter.

The purpose of this act in terms of the definition of adulteration is to protect the public in two ways:

1. To insure the delivery of the article labeled. Thus, an article labeled *honey* should contain honey and not glucose, a common adulterant.
2. To prevent the use of deleterious substances. Thus, it is important that bacteria or parasites be absent and that injurious drugs have not been used to cover up decomposition.

It is important to note the purpose of this act and help

in carrying out its provisions. Two points should be kept in mind:

1. Labels are frequently used which enable the manufacturer to be within the law, although in spirit he is frankly violating it.
   (*a*) Most patent medicines depend for their success upon the presence of alcohol in the mixture (Fig. 90). The amount of alcohol present must be stated, and it is—in small letters in an inconspicuous place (Fig. 91).

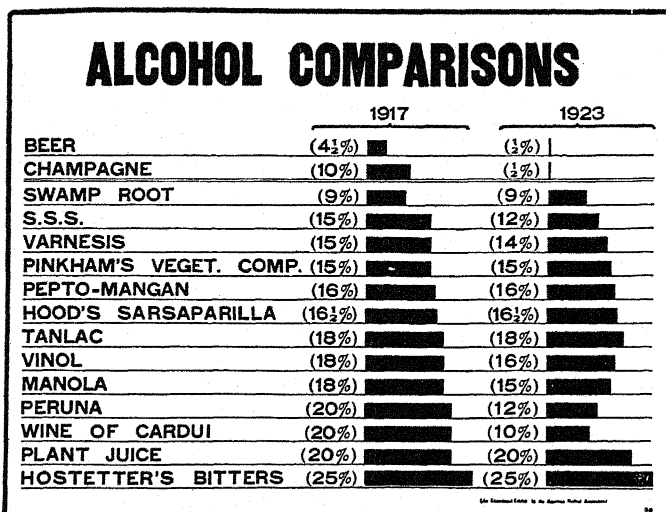

Fig. 90.—Whisky prescribed by the physician is to be preferred to patent medicines.

   (*b*) Jellies, jams, and catsups are frequently adulterated and the adulterant indicated in small type. For the first two it is usually glucose; for the last, benzoate of soda.

2. It is not necessary to use chemicals to preserve or can fresh wholesome food. Food, therefore, that has been treated indicates that the food was not in a fresh state. We do not know whether the minute amount

of the chemical used is injurious or not, but we do know that food in need of a preservative is not wholesome food.

Fig. 91.—Note the legal education of the above firm between 1905 and 1917, as evidenced by the labels. (By courtesy of the American Medical Association.)

The table given below, arranged from Broadhurst's[1] tabulation, gives the common adulteration in foods.

Food Substances.	Adulterant.	Remarks.
Candy	Clay or "terra alba"	
Cheese	Lard, bean meal, potato, bread	
Chocolate	Cocoa butter subtracted	

[1] Broadhurst, J.: Personal and Community Hygiene, J. B. Lippincott Co., Philadelphia, 1918, pp. 34, 35.

Food Substances.	Adulterant.	Remarks.
Cocoa	Starch, clay, brick dust	
Cocoa or chocolate	Cocoa shells	
Coffee	Cereals, acorns, date pits, red slate	
Coffee (specials)	Caffeine extracted	
Condensed milk	Cane sugar added to replace fats subtracted	Less suitable for infants.
Cream	Gelatin	
Figs	Worms and their wastes	
Flour	Talc, gypsum, alum, nitrogen peroxide	Poisonous nitrogen compounds do not prevent passing as "first grade."
Gum drops	Paraffin	
Honey	Glucose with pollen	Pollen is found in bee-collected honey.
Jellies	Turnips, squash	
Meat	Chemicals, such as saltpeter	To bring back red color to prevent caking.
Meat extracts	Plant extracts	Though cheaper, some plant extracts (*i. e.*, yeast) add valuable vitamins, yet they are considered adulterants unless properly labeled.
Milk	Formaldehyde	To defer souring.
Milk (whole)	Skimmed milk	
Molasses	Glucose	Lightens colors to higher grade appearance.
Nuts and fruit	Whitened by sulfur fumes	Injurious sulfur compounds retained by fruits and kernels.
Oleomargarine	Coloring	Sold as butter. Very wholesome. Legal restrictions now tend to keep up the price of both butter and its substitutes.
Olive oil	Corn oil, cotton seed oil	
Oysters	Fattened in water containing sewage	
Peas (green)	Colored by copper sulfur	
Salt (table)	Starch	
Sausage	Cereals	
Sugar (cane)	Saccharin	A coal-tar product.
Sugar (maple)	Glucose	Sweet, but lacking in food value.
Tea	Once-used tea leaves	

Alcohol, a distinct protoplasmic poison, has been defended in recent years because of its food value. There is little educational propaganda today on the food or health values of alcohol—such were shattered long ago. Some advocates of the use of alcohol have based their claims not on scientific truths, but rather on political "rights." Personal liberty has been invoked also as the shibboleth of bootleggers, brewers, distillers, and all those who make money out of the trade. The old selfish reasons are again presented, whereas the Prohibition amendment was passed not to save man from himself, but to protect society.

Alcohol and Length of Life.—Evidence from insurance and benevolent associations accumulates to the effect that the steady use of alcohol increases mortality. This appears to be true for even moderate users. If this is true, the "light wines and beer" advocates are without scientific and statistical evidence to support their plea of "harmlessness." Steady but moderate drinkers show a group mortality of 86 per cent in excess of the average.[1]

On the other hand, Pearl[2] in a study of alcohol and longevity among groups in Baltimore finds "that in a considerable sample of the working class population of Baltimore—moderate drinkers did live, on the average, just as long as total abstainers, and in truth a little longer."

Alcohol and Efficiency.—Experimental evidence of scientific and acceptable kinds shows that alcohol temporarily impairs memory, temporarily decreases the efficiency of workers, and resistance to disease. It has marked effect on bodily functions. This is especially to be noted in the circulatory and nervous systems. It increases the pulse rate, but not the force of the heart, and, acting as a depressant, which it really is, it lowers blood pressure. The classical work by Dodge and Benedict[3] shows the impairment of neuromuscular acts and gives the scientific background for

[1] Fisher, I., and Fisk, E. L.: How to Live, Funk and Wagnalls, 1921, p. 307. An extensive bibliography on alcohol is given in this book, pp. 333–338.

[2] Pearl, R.: Alcohol and Longevity, Knopf, New York, 1926, p. 228.

[3] Dodge, R., and Benedict, F. G.: The Psychological Effects of Alcohol, The Carnegie Institution of Washington, 1916.

the experience of employers as to its cause of accidents in industry.

Lord D'Abernon once remarked that complication in arriving at the true effect of alcohol on performance arises from the fact that, while alcohol gives the drinker the impression that he has performed the allotted task with unusual facility and success, impartial and objective examination shows that both accuracy and regularity have fallen below normal standard. Self-satisfaction has increased, but neither skill nor power. . . . In some Boston experiments it was found that the man who showed the highest average concentration in the blood and presumably in other body fluids also demonstrated the strongest alcohol effect, and likewise the lowest power of concentration and least accomplishment.

Herxheimer's experiments on 31 athletes showed that the ingestion of small quantities of alcohol four to six minutes before men entered upon 100-meter runs reduced performance considerably. Runners who received no alcohol ran the course in about two tenths of a second less than those to whom alcohol was given.

The early experiments of Stockard[1] added a further indictment of its use as a beverage. They showed an injury of male germ cells by alcohol to such a degree that offspring are distinctly impaired. In this instance also the laboratory brought support to the opinion of numerous social workers who had seen the effects of alcoholism in parent and child. Later work by Stockard[2] and recently a study by Pearl indicate that alcohol may possibly be a eugenic agent. Stockard's later work shows that until individuals of the most vigorous physical stocks have acquired severe alcoholism and later mated with similar vigorous persons to give rise to abnormal offspring, we cannot be certain that human alcoholism has produced degeneracy. In his experiments with

[1] Stockard, C. R.: The Effect on the Offspring of Intoxicating the Male Parent and the Transmission of the Defect to Subsequent Generations, *American Naturalist,* 1913, xlvii, p. 641; *American Naturalist,* 1916, l, pp. 65–88.

[2] Stockard, C. R.: Alcohol and the Germ Plasm. *Journal American Medical Association,* May 3, 1924.

animals he states that it is noteworthy that parental alcoholism increased the elimination of the weaker members of the progeny, many of them having succumbed before being born. His records show there is an excessive elimination of the weaker individuals among the grandchildren of alcoholic animals, and mostly before birth. In the third filial generation away from the alcoholic treatment, the affected germ cells are still being eliminated by early death of the embryos and young individuals but the animals that survive produce offspring that actually average better than the control stock. Those nations of men, he concludes, that have used alcohol through many generations have now, from a standpoint of performance and accomplishments, outstripped other nations with less alcoholism in their history.

Pearl[1] concludes likewise from a study of people and a summary of experimental work: "Experiments by various workers on such different forms of life as guinea-pigs, fowls, rats, mice, rabbits, frogs, and insects, agree in showing a beneficial effect of alcohol upon the race. This beneficial effect appears to be produced chiefly as result of the remarkably sharp and precise selective action of this agent upon germ cells and developing embryos, killing off the weak and defective and leaving the strong and sound to survive and perpetuate the race."

Numerous studies bear out many of the physiologic reasons advanced for national prohibition. Others report contradictory results. Those interested in the problem, however, must realize that all has not been said on the subject and in the light of many factors recently brought forward, the whole question needs continued study.

Coffee, Cocoa, and Tea.—The use of coffee, cocoa, and tea is so general that a dogmatic statement is antagonistic to many persons, and the views concerning the effects of such use so conflicting that a final statement at this time is impossible. It is probably always true that whenever statements vary widely the truth lies at some intermediate point. As regards coffee, it is unquestionably true that to some persons coffee is a poison, causing toxic eye conditions,

[1] Pearl, R.: Alcohol and Longevity, Knopf, New York, 1926, p. 227.

disordered digestion, and nervous disturbances. On the other hand, some persons drink it without any deleterious effects that are noticeable. The same may be said for tea and cocoa. It is unwise to say that coffee or tea will harm no one. It is foolish to condemn for all. The path of health in this instance must be determined by each seeker of a larger and more abundant life.

Some studies have been made. Lusk[1] notes: "Schumburg finds that coffee and tea have no recuperative power over the muscles of a fatigued organism, except when taken with other foods. Hillsten, exercising before breakfast, finds that the effect of taking tea is almost negligible" (in increasing muscle power). Again he[2] says: "When theophylline, caffeine and theobromine, the methylated purines found in tea, coffee, and cocoa, are ingested it has been stated that they are not oxidized to uric acid, but that they increase the purine bases in the urine. However, Levinthal and Stanley Benedict have found the uric acid elimination to increase in man after the ingestion of 1 to 1.5 Gm. of caffeine daily."

More recent investigations than those cited by Lusk indicate a certain effect on digestion that is more in harmony with experience than anything that has been stated heretofore empirically. Hawk[3] and his associates in a series of excellent studies on the gastric response to food studied the effect of tea, coffee, and cocoa (see page 262).

While not markedly interfering with digestion, tea and coffee did not aid the process. Cocoa distinctly retarded evacuation and the development of normal acid conditions. It should be noted that fluids ingested were taken with a uniform meal.

QUESTIONS AND EXERCISES

1. According to Sherman, what are the chief functions of food?
2. Describe briefly the processes of digestion, assimilation, and nutrition.
3. What is basal metabolism?

[1] Lusk, G.: The Science of Nutrition, W. B. Saunders Co., Philadelphia, 1919, p. 325.
[2] *Ibid.*, p. 532.
[3] Hawk, P. B., and associates: Gastric Response to Foods, XI; The Influence of Tea, Coffee, and Cocoa upon Digestion, *American Journal of Physiology*, vol. lii, No. 1, May, 1920.

4. Why is the heat produced in the body a sign of the metabolic activity of the tissues?

5. What facts lead to the conclusion that physical activity has a revitalizing effect in the body?

6. List the factors which influence metabolism.

7. What is a calorie? State the caloric value per gram of the three classes of foods.

8. List foods that yield energy.

9. List ten foods under each of the headings, proteins, fats, carbohydrates.

10. What foods build tissue?

11. Discuss the relative value of meat and vegetable proteins.

12. List the vitamins, give their sources and state their relation to health.

13. What is the rôle of mineral salts in the diet?

14. State the uses of calcium and list the foods rich in calcium.

15. What is the function of iodine in the body? State sources.

16. How much iron does the body need daily? State the functions of iron in the body. List foods rich in iron.

17. What is meant by reaction of the blood? What relation has food to this?

18. List the base-forming foods.

19. List the common groups of foods and state their functions.

20. Enumerate the controllable factors in the hygiene of nutrition.

21. Approximately how many calories do you need daily?

22. What percentage of these calories should be protein?

23. State briefly the conditions essential to hygienic eating.

24. Give briefly your conclusions regarding food fads and fallacies; alcohol; coffee; cocoa; tea.

CHAPTER VIII

HYGIENE OF THE RESPIRATORY SYSTEM

Anatomical and Physiological Backgrounds.—The function of the respiratory system in man is to bring air in contact with the blood so that oxygen can pass from the air to the blood and carbon dioxide from the blood to the air. The simplest type of arrangement for this purpose would be a surface respiratory membrane. When the organism is large and active the needs for oxygen and carbon dioxide interchange would require a very large membrane. This can be accomplished by an infolding of the respiratory surface as shown in Fig. 92. Developmentally the complex respira-

tory structures of man show this principle. The lungs arise as a pouch in the region of the pharynx (Fig. 93). By a process of invagination and extension, the developed lung presents many small sacs, each of which corresponds to the simple pouch of an elementary lung (Fig. 94). The struc-

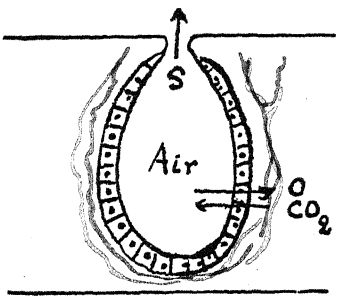

Fig. 92.—Diagram of an elementary lung: *S*, Stoma; *O*, oxygen diffusing from air of saccule into tissue fluids; CO_2, diffusing in reverse direction. (Burton-Opitz.)

tures that connect the interior of the lungs with the outside air are modifications of what is at first a simple tube.

If one were in imagination to travel the route taken by an inspired breath of air, the structures and functions of the various parts would be readily revealed.

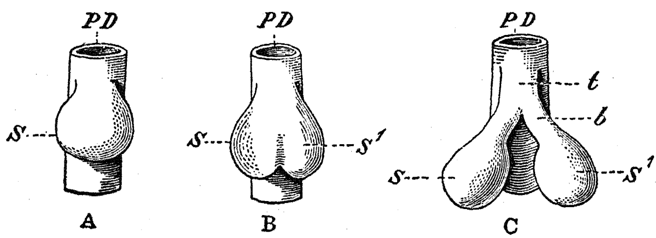

Fig. 93.—*A*, *B*, *C*, Diagrams showing the mode of development of the lungs: *b*, Bronchus; *PD*, primitive alimentary tube; *S*, S¹, the lung sacs, which are at first unpaired; *t*, trachea. (Wiedersheim.)

In the Nose.—One must elect one nasal passage for there are two of them. It would make no difference, however, for they are identical. The median wall in the normal nose

would be a straight partition, the lateral would present the three overhanging turbinate bones, each like the front fender of a stylish automobile. The air passing along their curving surfaces would be warmed; dust particles would adhere to their moist membranes. Several important openings would be observed along the under surface of the middle turbinate—the openings from frontal sinus, ethmoid cells, and maxillary sinus. Farther back are the openings from the sphenoid sinus.

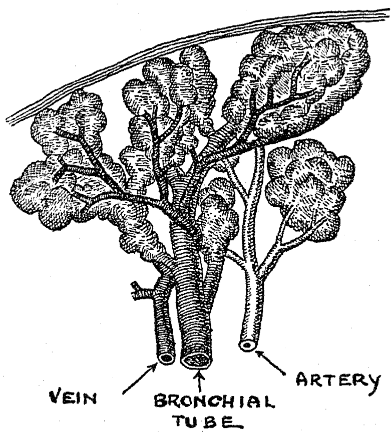

Fig. 94.—The bronchial tubes end in air sacs in which the interchange of oxygen and carbon dioxide of the blood readily occurs. Above is a diagram of a bronchial tube ending in numerous air sacs, and the appropriate blood vessels of the part.

As the traveler left the nasal passage to enter the pharynx, above his head might hang a structure resembling a cluster of grapes. Indeed this might be so large as to hinder greatly the passage of air. This might be seen in children but rarely in an adult for the obstruction is the adenoids.

In the Pharynx.—Swirling past this point, however, the traveler could observe on either side a crescentic roll of tissue in the curve of which there is an opening like a ground hog hole. This is the orifice of the eustachian tube that connects with the ear.

In the Larynx.—Then, downward past the opening from the mouth, and into the larynx. One might wonder as the air curved around the vocal cords, but these white glistening bands, would be explained later, on the outward journey, as the air passing over them sent these delicate membranes into vibrations of sound.

In the Trachea.—The inspired air is now in the main air tube, the trachea. Its surface is covered with minute hair-like structures, called cilia, that sweep in great movements, outward—like a wave blowing across a field of grain, carrying particles of material, not wanted in the tract, to the entrance where they can be coughed up and removed. Soon the trachea highway forks into a right and left road, the right and left bronchus. These are the main tubes of the corresponding lungs.

In the Lungs.—As the traveler continues, the road branches many times, becoming continually narrower. All of these innumerable paths finally end in a pouchlike structure that has many little sacs, the alveoli, constituting its walls. The alveolus is really a respiratory membrane; its wall is covered with capillaries, and the goal of the journey is at hand. Now interesting things begin to happen. The oxygen of the inspired air passes through the wall of the alveolus, the wall of the capillary, and enters the blood. Almost at once it enters into chemical union with the hemoglobin in the red cells, becoming now oxyhemoglobin. Like the peasant youth who travels a great journey to be crowned king, oxygen, widely distributed in ordinary air, travels through a highly complex passage to become oxyhemoglobin. And also carbon dioxide is to be observed passing from the blood through the same two walls that oxygen penetrated. It comes into the alveolus. This little drama has been going on in the 800,000,000 alveoli of the lungs—the number estimated of course—and the curtain is ready to fall for the act is finished. Perhaps an epilogue is needed to explain by what power the inspired air gets from outside into the alveolus, and what force operates to get it out of the alveolus.

How Air Enters and Leaves the Lungs.—An ingenious mechanism brings air into the lungs. Common speech in this

matter misleads. Air is not sucked in. The popular phrase, "It's all done with mirrors," is not wholly fanciful because the process appears at first mysterious. The key is pressure and the fact that air moves to places of lower pressure. By the contraction of the diaphragm and chest muscles, the chest is enlarged. The lungs keep in contact with the chest wall and hence the air pressure in the lungs is lowered. Therefore, since air flows to places of lower pressure, the contraction of muscles has produced a condition that results in air flowing into the lungs. The air is passive in the matter.

The opposite occurs in expiration. Muscular contraction compresses the lungs, air pressure within the lungs is increased, and air flows from the lungs to areas of lower pressure outside. As it passes over the vocal cords, these bands may assume positions so that sounds are produced.

The Essentials of Respiration.—One of the interesting aspects of the study of low forms of animal life is respiration. The very simple one-celled animals breathe without a special respiratory apparatus. In studying such forms it is determined that oxygen from the air passes directly through the cell membrane of the animal and carbon dioxide passes out. This records the primary fact that is noticed in respiration in man: oxygen of the air is taken up in the lungs and carbon dioxide is given out. This truth is made clear by a comparison of the composition of air, both inspired (outdoor) and expired:

	Nitrogen.	Oxygen.	Carbon Dioxide.
Inspired air	79	20	0.04
Expired air	79	16	4.0

The essential fact, then, in human breathing is the bringing of air into the lungs so that oxygen may be taken from it and carbon dioxide given to it.

This knowledge of the use made of oxygen of the air and of the need of the body for the vital gas has been known for a long time, but usually it has been interpreted erroneously with reference to ventilation studies. Carbon dioxide for many years has been considered the dangerous element in bad air. Dr. Chaumont set the standard in this respect in 1875 at 6 volumes per 10,000 as the limit of vitiation. In

America many of the states have laws that require school rooms to be so ventilated that not more than 6 parts of carbon dioxide in 10,000 shall be allowed. For many years this has been the accepted standard, but by numerous ventilation experiments it has been shown that CO_2 may be increased to 12 volumes without deleterious effects. Furthermore, it has been demonstrated that from a health standpoint the physical conditions of the air are usually more important than the chemical, and that control of air moisture, temperature, and motion are generally more to be desired than control of the chemical conditions as represented by CO_2. For some time the "badness" of inside air was attributed to an organic poison. Weichart claimed to have isolated an organic substance which was responsible, but his experiments have not been confirmed. On the contrary, the evidence indicates that vitiated air is produced by other factors. From the studies of Hill, Flügge, and more recently of the New York Commission on Ventilation,[1] it has been demonstrated that the "badness" in air in ordinary buildings is not due to an organic poison, nor to excessive amounts of carbon dioxide, but rather to:

1. Improper temperature, usually too high a temperature.
2. Improper humidity.
3. Lack of air movement.

The New York Commission on Ventilation[2] says: "A study of the health of pupils in school rooms ventilated by unit ventilators shows that reducing the rate of air flow from the standard figure of 30 cubic feet per pupil per minute to approximately one half that amount was not attended by any harmful effects so far as could be observed. In our experience the teachers preferred the rooms with low air flow on account of freedom from drafts and the lessened noise of the unit motors.

"A comparison of school rooms ventilated with unit ventilators and of those ventilated by window inlets with gravity exhaust shows that the simpler gravity process is

[1] New York Commission on Ventilation, Studies of School Ventilation. Collected Reprints from *American Journal of Hygiene,* July, 1930; January, 1931; July, 1931; and January, 1932.

[2] *Loc. cit.,* January, 1931, p. 254.

quite as satisfactory from the health standpoint as is the system involving the use of fans."

Earlier reports[1] indicated also that the health of pupils in the grade schools is at least as favorably influenced by old-fashioned window ventilation and air ducts as by the newer types of pressure ventilation. It seems indicated that expenditures for elaborate and expensive ventilating machinery are unwarranted.

Desirable Temperature—Proper Methods of Heating.—The desirable temperature for indoor air is 68° F. It should never go below 66° nor above 70° F. The relation of temperature to humidity and its effect upon health has been stated above. Huntington[2] shows that temperature influences work done.

Every school room and every home should possess a thermometer and a definite effort should be made to keep the temperature constant and at the proper elevation.

When rooms are heated by stoves this is nearly impossible. It is difficult with hot air furnaces. The best methods of heating are with hot water or steam.

Mechanical methods of ventilation in school buildings have not justified themselves and probably are less healthful than open-window gravity methods.[3]

Equable Temperature.—Equable temperature is very desirable. Sharp variations in temperature tax the heat-regulating system of the body, and frequently cause disturbances of the gastro-intestinal tract. With many persons a sense of bodily well being is very dependent upon an even temperature. In this country southern Florida and southern California afford the best illustrations of equable climate. The effect of atmospheric conditions upon fatigue and effi-

[1] The school ventilation study in the Bellevue-Yorkville District of New York City, New York Commission on Ventilation, 1929. Ventilation: Report of the New York Commission on Ventilation, E. P. Dutton & Co., New York, 1923.

[2] Huntington, E.: Civilization and Climate, pp. 80–110, Yale University Press, New Haven, 1915.

[3] It should be noted that the mechanical system of ventilation may be administered more easily than the open-window system, and likewise that it is frequently "out of order." See McLure, J. R.: The Ventilation of School Buildings, Bureau of Publication, Teachers College, 1924.

ciency has been studied by Winslow,[1] and his results show the need for careful regulation of indoor temperature. A comparison of infant mortality and temperature changes in Chicago from 1907 to 1912 is shown in Fig. 95. Ward[2] mentions the following characteristics in climate as desirable

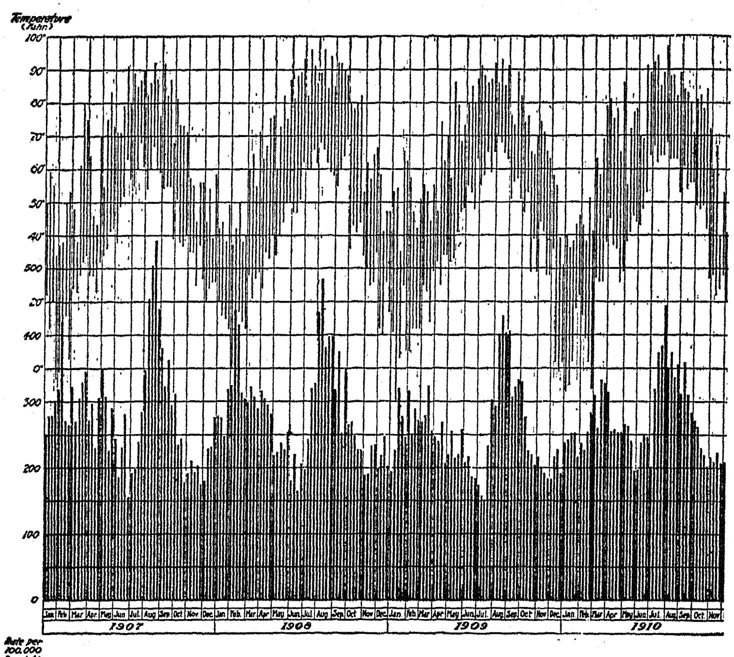

Fig. 95.—A comparison of weekly infant mortality and temperature changes in Chicago. Note the rise in mortality (lower graph) with the increase in temperature (upper graph). (By courtesy of The Prudential Insurance Company of America.)

for health: frequent moderate weather changes, fairly marked annual and diurnal variation in temperature, reasonable amount of cold during part of the year, variety in amount

[1] Winslow, C.-E. A.: The Effect of Atmospheric Conditions upon Fatigue and Efficiency, *American Journal of Public Health*, October, 1917, pp. 827–834.

[2] Ward, R. D.: Climate and Health, *Scientific Monthly*, April, 1921, p. 355.

of cloudiness, rainfall sufficient for grass and crops. He would advise that extremes be avoided.

Proper Humidity and Means to Secure It.—Water is always present in the atmosphere. While outdoor air varies greatly in its water content in different places and at different times of the year and day, the variation between the amount of water vapor in indoor air and outdoor air constitutes a prominent factor in the unwholesomeness of indoor air. The absolute amount of water present in indoor air is not the entire statement in this connection, but the amount of moisture that can still be taken up at the prevailing temperature. Buildings ventilated by open windows present little or no difficulty because the outdoor humidity usually controls. The problem is chiefly one related to artificial systems of ventilation, as in schools, and to a certain extent in modern homes, where little or no attention is given to ventilation by means of windows. Air conditioning today is successful in the attempt to secure indoor conditions different from outdoor.

The desirable humidity is often stated to be 60 per cent (relative). This does not provide against the danger of excessive temperature with the resulting dryness of the air. The relative humidity may remain at 60 per cent and the air may be able to take up considerable water vapor, as indicated by the following table from Rosenau:[1]

Relation of Humidity and Temperature

Temperature (C.).	Relative humidity, per cent.	Absolute humidity, grams per cubic meter.	Grams of vapor that can still be taken up.
—20°	60	0.638	0.426
—10°	60	1.380	0.920
0°	60	2.924	1.950
10°	60	5.623	3.749
20°	60	10.298	6.866
30°	60	18.083	12.056

Note: To reduce degrees Centigrade to degrees Fahrenheit multiply by $\frac{9}{5}$ and add 32 degrees.

[1] Rosenau, M. J.: Preventive Medicine and Hygiene, D. Appleton & Co., New York, 1913, p. 608.

The unwholesomeness of most indoor air with reference to its water content lies in its excessive dryness. With the temperature correct, this danger may be lessened, and it can be said that air at a temperature of 68° F. and a relative humidity of 60 per cent will usually be satisfactory.

There is no method for determination of relative humidity that will be found practicable in the home, because it involves the use of an instrument that requires adjustment, reading, and interpretation by means of a table. Therefore, the guide is to be a sense guide, dependent upon an interpretation of dryness of the mucous membranes, especially that of the nose.

In the school accurate determination may be made and records kept, and the procedure may be made not only contributory to general sanitary improvement but also helpful in training in methods of hygiene. For this purpose the sling psychrometer is used.

Methods used to prevent excessive dryness in the air include:

1. Open window ventilation.
2. Liberal use of potted plants in the room.
3. Pans of water placed, where it will evaporate, under or on radiators for steam and hot-water heating, and in furnace chambers for hot air. Just how valuable are these methods is not known but they may help. Reliance upon open windows is more desirable, however.

Excessive dryness of the air causes absorption of water from the body, especially from the mucous membranes. Man's body is about 58.5 per cent water, so that the water loss in this way may well be a serious matter. The loss of moisture from exposed membranes interferes with their normal functioning.

Effect of Wind on Metabolism.—Wind and humidity have pronounced influences on metabolism. Wolpert's experiment as quoted by Lusk[1] gave the results shown in the table on page 291.

Thus it would appear that the metabolism would be more marked with a breeze moving about 15 miles an hour (8

[1] Lusk, G.: The Science of Nutrition, W. B. Saunders Co., Philadelphia, 1919, p. 146.

INFLUENCE OF WIND ON METABOLISM IN MAN

Temperature (C.).	Calm.	Wind—1 meter per second.	Wind—8 meters per second.
	Grams CO_2 per hour.	Grams CO_2 per hour.	Grams CO_2 per hour.
2°	29.8		
10°–15°	25.1	28.3	30.0
15°–20°	24.1		30.1
20°–25°	25.0		28.0
25°–30°	25.3	22.2	24.4
30°–35°	23.7		21.6
35°–40°	21.2	22.2	22.1

meters per second) at a temperature of 59° to 63° F. than with a temperature of 35° F. in a calm. The scientific basis for many hygienic practices in clothing the body is given in this experiment. The body is easily chilled in a wind due to loss of body heat by rapid evaporation.

Effect of Humidity on Metabolism.—The work of Wolpert was conducted on a thin man clad in summer clothes. Rubner, working with a fat man wearing clothes, obtains, according to Lusk,[1] the following results:

INFLUENCE OF TEMPERATURE AND HUMIDITY ON THE METABOLISM OF A FAT MAN

Temperature.	Humidity, 30 per cent.		Humidity, 60 per cent.	
	CO_2 in grams per hour.	H_2O evaporated per hour.	CO_2 in grams per hour.	H_2O evaporated per hour.
20°	33.7	56	30.7	17
28°–30°	36.9*	134	44.5‡	170 319 sweat
36°–37°	42.6†	204 149 sweat	46.7§	186 2559 sweat

* Body temperature rose 0.1 degree.
† Body temperature rose 0.0 "
‡ Body temperature rose 0.4 "
§ Body temperature rose 0.9 "

Note:
20 C. = 68 F.
28–30 C. = 82– 91 F.
36–37 C. = 97–100 F.

[1] *Loc. cit.*, p. 147.

On a hot, humid day the heat lost from the body is by evaporation of water. This is retarded by the humidity. Humidity by preventing the evaporation of perspiration on a hot day results in depression of the body. This is due to the exhaustive elimination of perspiration which by non-evaporation is prevented from cooling the body. If the temperature is moderate the heat loss may take place through radiation and conduction, so that perspiration is not so excessive. Lusk[1] comments upon this effect of humidity and temperature as follows:

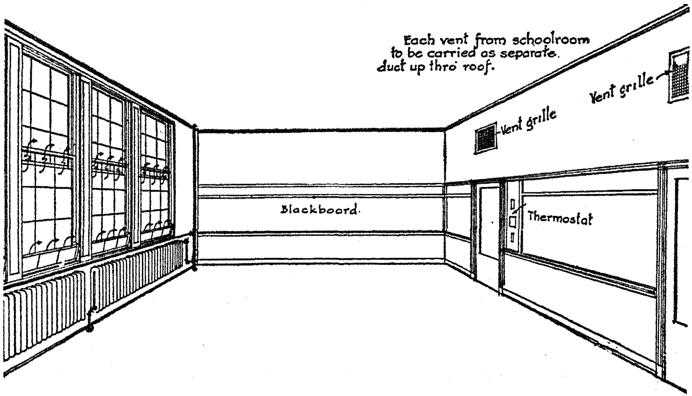

Fig. 96.—Interior of room of Thomas Snell Weaver Memorial High School, Hartford, Conn., showing radiators extending under open windows, with ventilating flues on opposite wall. (Courtesy of Frank Irving Cooper Corp., Architects.)

"It is also interesting to note that prostrations from the heat occur in New York with 66 per cent humidity and a temperature of 31.5° C.[2] (2.30 P. M., August 24, 1905)."

Air Movement and Means to Secure It.—It has been found that many of the ill effects of bad ventilation can be avoided by keeping the air of the room in motion. Hill, in England, and Flügge, in Germany, demonstrated that air movement was an essential element in well-ventilated rooms. In still air the body becomes surrounded by a jacket of

[1] Lusk, G.: *Loc. cit.*, p. 148.
[2] About 89° F.

warm moist air which produces the familiar symptoms of a vitiated air, even with the CO_2 content well below 6 volumes.

Movement of air in rooms is very desirable and should be secured. This may most readily be accomplished by opening windows (Fig. 96). Many persons do not know how to open windows. If the room seems badly ventilated, some one who doesn't know how may open the windows widely so that those near the windows are suddenly chilled. It usually happens that some one in the group near the windows replies by tightly closing them. Both err. To secure air movement the windows should be opened a small space only and preferably at top and bottom, but top at least.

Air movement may be supplemented by an electric fan.

The fear that some persons have for drafts is very real, but it is often a developed fear, dependent upon coddling of the body, and should be overcome by proper dressing and bathing. Air in movement sufficient to prevent unpleasant and unhealthful effects may be secured without injury to health. The rate of movement in relation to our perception as given by Rosenau is as follows:

Air moving at 1.5 feet per second—1 mile per hour—imperceptible;
Air moving at 2.5 feet per second—1.7 miles per hour—barely perceptible;
Air moving at 3.5 feet per second—2.3 miles per hour—draft.

The term "draft" is relative. To some persons a blowing wind is not recognized as a draft; to others the slightest air movement is a strong draft. It is significant that the New York Commission of Ventilation,[1] after an extensive research on vasomotor reactions to localized drafts, says: "There has been nothing in our findings to indicate that localized drafts produce any derangements of vasomotor reaction differing in such a way from those caused by uniform chilling of the body surfaces as a whole, as to suggest a special influence on respiratory infection."

Control of Dust and Dirt.—Dust is a normal constituent of the atmosphere and it serves a very useful purpose as a focus for water vapor precipitation, as a disperser of the

[1] New York Commission on Ventilation, *American Journal of Hygiene*, January, 1932, p. 33.

sun's rays with decrease in the transparency of the air. Dust particles are derived from the earth, carbon particles in smoke, volcanoes, salt from sea spray, interplanetary particles, mineral dust from certain occupations, and organic dust, such as, "epithelial scales, seed, spores, bacteria, pollen, plant cells, fluff of various kinds, bits of insects, starch, pus cells, algae, rotifers, fragments of hair, feathers, and bits of tissue, fibers of cotton, etc."[1]

The dust of great danger from a health viewpoint is mineral dust from trades. The dust from the earth, smoke, or refuse heaps is unpleasant, but mineral dust is distinctly injurious.

Influence of Mineral Dust in Air on Health.—The dust from mineral sources is injurious when present in large amount and when, as is usually the case, the particles are sharp and cutting, serving to irritate body tissues. Thus in coal mining, iron and steel trades, stone cutting, and other dusty trades the dust is present in large amounts and is extremely irritating. The lungs are the chief organs to suffer and so definite is the injury to the lungs that the affection resulting is named according to the cause of the disease. Thus, *anthracosis* is caused by coal dust; *siderosis*, by iron or steel dust, and *silicosis*, by stone dust.

Kober and Hanson[2] have shown that the effect of dust and fumes on the upper air passages may be marked.

"Dr. Collis, after examining thousands of grinders and granite cutters and others exposed to inhalation of dust in Sheffield, Aberdeen, and elsewhere, found, as a rule, that the lining membrane in the interior of the nose for a distance of $\frac{3}{4}$ inch was smooth, dry, and pale colored; the mucous membrane behind this was red and inflamed and generally covered with dust, while the back of the pharynx and pillars of the fauces were tolerant of the touch of the spatula used to depress the tongue, having lost their sensitiveness."

The pall of smoke that hangs over large cities is a health

[1] Rosenau, M. J.: Preventive Medicine and Hygiene, D. Appleton & Co., New York, 1913, p. 603; ibid., p. 626.

[2] Kober, G. M., and Hanson, W. C.: Diseases of Occupation and Vocational Hygiene, P. Blakiston's Son & Co., Philadelphia, 1916, p. 297.

hazard. It prevents the immensely valuable violet rays of the sun reaching the earth. This urban handicap added to the custom of wearing clothes keeps from the body health-giving sunshine. The condition could be improved greatly by effective smoke control.

Taylor reports that in Manchester, England, "20,000 tons of solid matter falls annually in the city area and tar and acids to the amount of 75,000 and 200,000 gallons, respectively."

Brend in a study of infant mortality reports that "neither poverty, bad housing, insufficient feeding, defective sanitation, disease, industrial occupation of women nor malnutrition of mothers can be regarded as adequate to explain the excessive difference between urban and rural mortality." In 1928 the deaths of infants under one year per thousand births were 74.4 in urban against 55.5 in rural districts. Brend believes that this difference is the result of a smoky and dusty atmosphere.[1]

Bacteria in Air.—Bacteria in outdoor air do not constitute a very serious danger, and, in fact, do not have the importance that people usually attach to the matter. Bacteria do not multiply in the air, and most of them soon die, especially when exposed to sunshine. It may be safely said, therefore, that bacteria coming in the air directly from another person in the liquid spray from coughs or sneezes are very dangerous, but if they are not received directly from another person, the danger is very small indeed. The expired air is practically free from bacteria. In coughing, sneezing, talking or other forced respiratory movements, however, the expired air contains bacteria. This indicates how droplet infection occurs.

The air has been considered in former times to be a prolific source of disease. Malaria (bad air) and other diseases, such as typhoid fever, yellow fever, and rheumatism, were supposed at one time to be communicated by the air. The knowledge of these diseases today rules out entirely, however, air as a factor in causation. The advances in epidemiology show

[1] Foreign Letters, London, *Journal American Medical Association*, June 21, 1930, p. 2006.

that bacteria in outdoor air are usually harmless; in crowded places, such as street cars, school rooms, and other closed and poorly ventilated places, where human beings come in close contact, the danger of disease transmission is very real. The process, however, is that of direct contact by means of a droplet or spray of infection from the nose or mouth of another person.

The Value of Sunlight.—The value of sunlight in the modern treatment of tuberculosis and rickets[1] illustrates the saying of Pliny, the elder, who wrote "Sol est remediorum

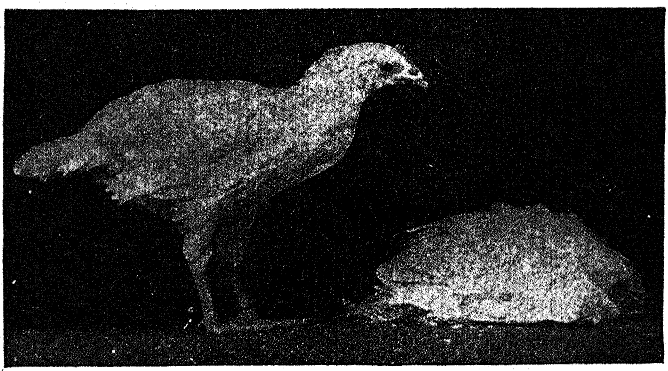

Fig. 97.—The effect of one-half hour exposure to direct sunlight daily (left) in contrast to chick on right, suffering from rickets (leg weakness) is shown. Both birds were of the same age and received the same ration. (Nation's Health, October 15, 1925, p. 699.)

maximum." The sun is the greatest cure for many things. Its value in the maintenance of general health is less appreciated than it should be (Fig. 97). Part of the splendid effects of an out-of-door life is due to the sunshine. The ancients appreciated this fact more than we moderns do, as shown by the herlioses of the Greeks, and the solaria of the Romans.

The solar spectrum varies according to the path of the

[1] Hess, A. F.: Experimental Rickets in Rats, *Journal of Biological Chemistry*, January, 1922, p. 77. McCollum, E. V.: Is There More Than One Kind of Rickets? *American Journal of Diseases of Children*, February, 1922, p. 91.

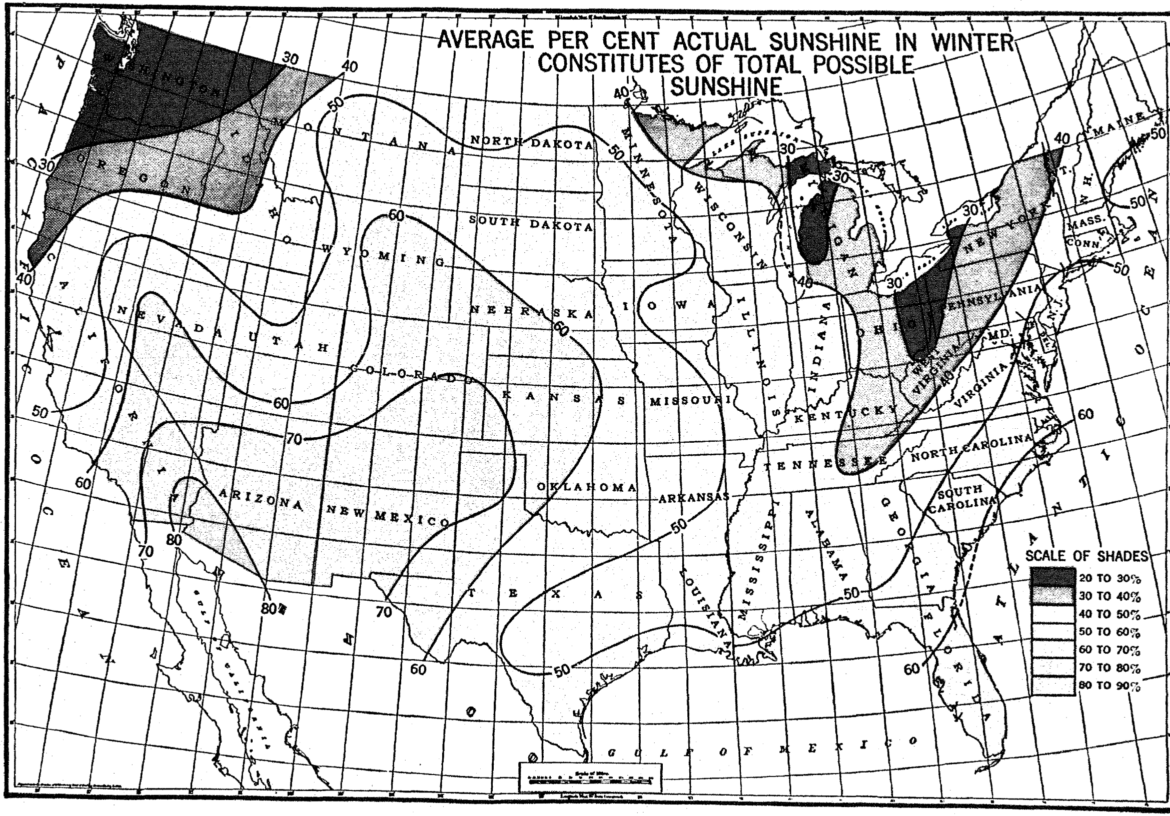

Fig. 98.—During the winter months the average number of hours of sunshine for the entire country is 36 per cent less than in the summer—in some areas 50 per cent less. There are times when the sun is invisible or scarcely visible for

rays, dependent upon the height of the sun. The sun in the zenith is a yellowish white, while the sun on the horizon may be blood red. The amplitude of the ultraviolet radiation varies widely with the total heat radiation. It is not because the sun in summer is so much hotter, but because it dispenses a much higher percentage of ultraviolet rays that with the sun in the zenith marked injuries occur to the skin and even to the whole organism. The sun's rays in the spring are richer in ultra-red rays than in the autumn in ultraviolet rays. Our skin does not tan in winter because the most effective rays are no longer present in the solar spectrum.

Surveys have been made of the varying amounts of sunshine available in cities. Manville[1] has called attention to the extent to which smoke and fog may obstruct the ultraviolet rays. According to Manville Maine, Vermont, New York, the Ohio Valley and Portland, Oregon have very low averages of sunshine. Various proposals have been made to substitute for this deficiency in the environment. Irradiation of people and irradiation of foods have been proposed. Doubtless more attention should be given to abatement of smoke pollution and to dress reform. "Sun suits" for children have been in style recently. It is to be hoped that the vogue continues.

A recent study[2] in Chicago showed that from September to April the sunshine in that city is deficient in the ultraviolet rays. Persons residing in localities with such deficiencies must resort to other sources of ultraviolet energy (Fig. 98). A physician should advise in such a problem.

Civilized man in the temperate zone by taking on clothing, by living so much indoors, protects himself unduly from the sun's rays. On exposure to strong sunshine he shows a marked susceptibility to sunlight. A careful and gradual exposure in the summertime would generally result in improved function of the skin, increased nutritive changes,

[1] Manville, I. A.: The Ultraviolet Component of the Sunlight of Portland, Oregon. *American Journal of Diseases of Children,* May, 1929.

[2] Tonney, F. O., et al.: Actinic Measurement of Solar Ultraviolet Light and Some Correlations with the Erythema Dose, *Journal Preventive Medicine,* November, 1928.

enrichment of the blood, particularly the hemoglobin content, and improved nerve action. In the tropics man suffers from the excessive sunlight. Woodruff[1] names excessive sunlight as the cause of backwardness in these regions. One unaccustomed to sunlight should avoid prolonged exposure at first. Sunburn, headache, sleeplessness, and other signs of discomfort following exposures to the sun indicate too sudden or too prolonged periods. City persons on vacations in the country frequently err in this regard. Gradually increasing the amount of body surface exposed and the time spent in the sunshine will bring valuable results, if unfavorable signs are recognized and acted upon accordingly.

Artificial Sunlight.—Regarding the many claims put forward to establish the special merits of particular lamps that are advertised to provide artificial sunshine, it should be remembered that there is nothing mysterious and hidden about mercury arc and carbon arc lamps. The Bureau of Standards of the Department of Commerce has given in a scientific pamphlet, number 539, the comparative values of different types of lamps.[2]

Nature's Plan for Respiration—the Respiratory Tract.—The general plan provides that air be taken in through the nose, where dust and dirt are in part removed and the air properly warmed before passing on through the trachea (windpipe) to the lungs. Nature in all mechanisms of the body provides a margin of safety, and that principle is seen in the provision that air may be breathed in through the mouth. This is an emergency entrance, however, and is not adapted either in general structure or function for respiration. Nose breathing alone is justifiable and should be practiced. Obstructions in the nose in the forms of adenoids, growths, or deformities should be removed to secure free passage so essential for proper breathing and vigorous health.

[1] Woodruff, C. W.: The Effect of Tropical Light on White Men. Clark, J. H.: The Physiological Action of Light, *Physiological Reviews*, April, 1922, pp. 277–309.

[2] This paper can be secured from the Superintendent of Documents, Government Printing Office, Washington, D. C., price 15 cents, postpaid.

The Muscular Mechanism for Respiration.—Nature has provided a muscular mechanism by which man may increase the size of the chest cavity and allow air to rush in. This mechanism allows for an increase from side to side, from back to front, and from top to bottom.

The complete mechanism includes the intercostal muscles and diaphragm. Individuals with marked fears, inhibitions,

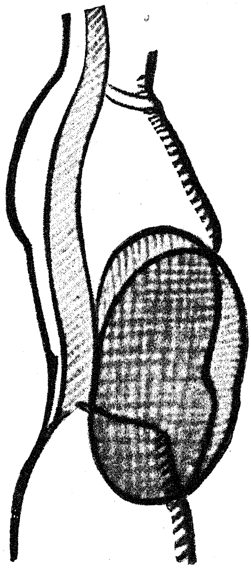

Fig. 99.—Diagram to illustrate action of the diaphragm and the corresponding action of the anterior abdominal wall. The descent of the diaphragm (red) results in increased intra-abdominal pressure which is compensated normally by anterior bulging of abdominal wall (blue). (From Mollier, "Plastische Anatomie," J. F. Bergmann, Publisher.)

and various personality defects characterized by muscular hypertension exhibit typically intercostal breathing. In such breathing, the diaphragm is not used as the normal piston in the abdominal cylinder. Thus, an important factor in breathing is neglected and the diaphragmatic relaxation that should occur rhythmically fails to develop. These individuals are unable to expire freely, and even ordinary

respiration, with its lift and descent of the chest, leaves them at the end of expiration in a depressed motor state that has significant psychic meanings.

The natural method of respiration is one that calls into action both diaphragm and intercostal mechanisms in which the greatest expansion comes in the lower chest and epigastrium. In this form, however, the diaphragmatic action should be stressed (Fig. 99). For persons with emotional difficulties, restriction of breathing to the diaphragmatic type may have desirable therapeutic outcomes, especially if accompanied with rational efforts at orientation and control.

Automatic Control.—The rate and frequency of respiration is controlled by a group of nerve cells, the respiratory center in the medulla, acting in response to changes in the blood. True it is that we can *voluntarily* breathe deeper and faster, but clearly also, whether we do or not *voluntarily* is not related to the physiologic requirements of the body. When running or engaged in feats of speed, strength, or endurance the act of respiration goes on without conscious direction, and because of this essential automaticity, satisfying, as it does, the needs of the body, an attempt of the voluntary or conscious kind is unnecessary and unhygienic. Certainly at no time or place does any individual know how fast or how deep he must breathe to eliminate the carbon dioxide produced by activity. The respiratory center does know, however, and if uninterrupted it will under all normal conditions carry out its demands and fulfil its physiologic obligations.

In persons using the high chest intercostal type, not only are respiratory needs met with difficulty, but also the accessory values in abdominal breathing on circulation and nerve action are lost.

The Matter of Breathing Exercises.—There is probably less clear thinking among physical educators on the subject of breathing exercises than on any other aspect of body training. Hall,[1] who marches in the procession with those

[1] Hall, G. S.: Adolescence, D. Appleton & Co., New York, 1904, p. 102. For a wholesome view of this subject read Cabot, R. C.: A Layman's Handbook of Medicine, pp. 18, 19.

who give prominence to play and games as contrasted with formal gymnastics, makes the following absurd statement:

"Deep breathing, however caused, no doubt acts against auto-intoxication, gives increased power to resist disease, is the root of endurance under effort, and is of great and hitherto unsuspected importance in determining the level or intensity of life, one of the chief variables with which the rate and completeness of normal oxidation of the blood is correlated."

The above statement, pointing toward chemical changes, may well mean that respiratory gymnastics in one's room before an open window, as is customary with those who pursue this fad, will determine "the level or intensity of life" to the advantage that "auto-intoxication" is done away with and "endurance" is strengthened at the root. President Hall has such a keen appreciation of the biological values in life that it is disconcerting to find him expressing such opinion.

It is important to point out that breathing exercises, designed to secure chemical change of oxygen and carbon dioxide, are unscientific and not physiologic for the following reasons:

1. Oxygen cannot be stored up in the body. The passage of oxygen from the air chambers of the lungs to the blood and thence to the tissue is dependent upon the need of the body cells for oxygen. If physical activity is increased, oxygen is required, and hence respiration is increased in rate and depth. Burton-Opitz[1] says in this connection:

"The relation between the quantities of O absorbed and CO_2 liberated during a given period of time is designated as the respiratory quotient.

"The rate and depth of the respiratory movements do not appreciably change the relationship of the O and CO_2.

"The general arrangement of the intracellular material constitutes the principal factor in the determination of the manner in which the dysoxidizable food-stuffs combine with oxygen. On this account there is imparted to the oxidations definite specificity and a limit is set to them in conformity with the requirements of the different tissues. *Consequently, the magnitude of the oxidation is regulated by the tissue itself and not by the amount of oxygen actually available.*"

[1] Burton-Opitz, R.: A Text-book of Physiology, W. B. Saunders Co., Philadelphia, 1920, pp. 507, 511, 514, 516, 517.

There is abundant physiologic evidence to show that the arterial blood is in a state of almost complete saturation and that this normal state is possible with an oxygen tension of little more than 30 mm. Hg, although the normal tension is at least 100 mm. Hg. In short, that natural respiration amply safeguards the needs of the tissues. Moreover, as Burton-Opitz says:

> "But even if this gas (oxygen) is supplied in pure form so that its pressure is increased five times, namely, from 152 mm. Hg to 760 mm. Hg, no considerable variation in the consumption of oxygen and output of carbon dioxide results."

2. By respiratory exercises the proportion of oxygen to carbon dioxide in the lungs and blood can be temporarily increased, but only at the expense of the physiologic equilibrium of the body. An illustration of this disturbance may be seen by breathing deeply and rapidly for one or two minutes. The nausea, headache, disturbance in vision, and other sensory manifestations indicate the unhygienic effect of the procedure. Henderson's[1] experiments in this field have been especially valuable in confirming this view.

   Investigators have observed that spasms and muscular twitchings may follow voluntary overbreathing. It may cause symptoms of tetany, the factor being alkalosis, due to reducing the amount of the blood carbon dioxide, and making the blood more alkaline than normal.

3. The voluntary taking of oxygen regardless of the needs of the body is unphysiologic and irrational. The quantity of oxygen taken up by the cell is conditioned by the needs of the cell. Pflüger's[2] work on the combustion of living material showed that

[1] Henderson, Y., and associates: The Influence of Forced Breathing upon the Circulation, *The Journal of Pharmacology and Experimental Therapeutics*, April, 1918. The Time That the Breath Can Be Held as an Index for Acidosis, *Journal American Medical Association*, July 25, 1914. Haggard, H. W., and Henderson, Y.: How Oxygen Deficiency Lowers the Blood Alkali, *Journal of Biological Chemistry*, vol. xliii, No. 1, 1920.

[2] Pflüger, H.: Ueber die physiologische Verbernnung in den lebendigen Organismen, Pflüger's Arch., x, p. 350, 1875.

Barcroft[1] has sustained his position. The respiratory center provided by nature to regulate the oxygen supply in accordance with the body needs is a better guide than any voluntary, arbitrary, and empiric method. No individual at any time knows how much oxygen is needed.

4. The use of breathing exercises following a gymnastic lesson is unscientific[2] and should be discontinued. No teacher can tell the respiratory needs of any one pupil; how futile to set a respiratory rate for 40 children when there is not sufficient knowledge to guide intelligently, and when respiratory needs vary tremendously in different individuals.
5. The use of breathing exercises to increase the size of the lungs and chest, unless used for corrective or therapeutic purposes in individual and prescribed-for cases, is unscientific and dangerous. Lung development should be an expression of increased respiratory need and should follow as a response of the respiratory mechanism to the need for oxygen by the tissues of the body. It would be as irrational to develop a large heart out of proportion to the rest of the body as it is to develop large lungs without reference to body needs.
6. The old belief that breathing exercises and large lungs were inimical to the development of pulmonary tuberculosis is unfounded in fact. Tuberculosis is related directly to personal habits, sanitation, and sources of contagion. Weisman in a study[3] of children with and without tuberculosis shows that the flat chest appears to be the healthy chest, that the round chest is more prone to tuberculosis, and that

[1] Barcroft, J.: The Respiratory Function of the Blood, Cambridge University Press, London, 1914, p. 73.

[2] Burton-Opitz has unpublished data clearly showing that the tidal air is greater under conditions of maximum respirations with the arms hanging easily at the sides than with the arm movements usually employed in breathing exercises.

[3] Weisman, S. A.: Contour of the Chest, *Journal American Medical Association*, July 23, 1927, p. 281.

the flat chest has over 50 per cent greater vital capacity than the round chest.

7. Since tuberculosis develops most frequently in the apex, the less frequently used portion of the lungs, it would seem to be dangerous to develop a very large lung and thus produce a larger area not used continually.[1] A lung that is related to the habits of exercise, life, and needs of the individual is a better mechanical instrument than one much larger in size and power and unrelated to the physiologic body requirements. In the latter case it is reasonable to suppose that such a lung would be more susceptible to disease because of the larger unused area.
8. The evils aimed at in breathing exercises are to be corrected by physical exercise that will not only produce increased respiratory action and gaseous interchange, but also will give additional hygienic effect.
9. Individuals manifesting hypertension and restricted intercostal breathing should be taught how to use properly the diaphragm.

Health of the Respiratory System.—Health of the lungs and respiratory tract is dependent upon many factors. The general health of the body, digestion, circulation, and elimination are important factors. The air breathed, the condition of the nose and throat, and the matter of exercise in the open air are important. Specific directions for avoiding tuberculosis will be given later, but aside from this infection, and for the maintenance of good condition in the pulmonary system, the following points are to be noted:

1. Nose breathing is essential. The nares are constructed to warm cold air and to screen out from the air dust and germs. If necessary, surgery should be employed to free the nares from adenoids, spurs, growths, and other obstructions.

[1] Sewall, H., and Swezey, S.: *American Review of Tuberculosis*, September, 1921, p. 547. Beasley, T. J.: *Journal American Medical Association*, February 25, 1922, p. 579.

2. Cold bathing is invaluable for keeping the tone of the body and especially the tone of the mucous membranes of the respiratory tract in good condition. Numberless persons have freed themselves from "colds" by a faithful habit of the morning cold bath.
3. The best exercise for lung development is running for boys, and dancing for girls in the open air. Swimming, mountain climbing, hiking, and outdoor games are more important than any respiratory gymnastics ever devised.
4. In the prevention of colds the following should be noted in addition to cold bathing:

   (1) Sufficient sleep in well-ventilated room. If body is well protected by bed clothing, there should be no fear of drafts. A direct draft upon the head is undesirable.
   (2) Avoid close, poorly ventilated rooms, and especially those with high temperature.
   (3) Avoid chilling the body. Keep the body warm when riding or sitting quiet. When walking or exercising there is no danger; the mistakes are made when resting following the activity.
   (4) Keep the general health at the best and highest level possible.

Colds.—Colds are very common health disturbances and because they are not liable to cause immediate death they are regarded by many people as of no great importance. Hutchinson suggests, however, that a person's age is not dependent upon the number of years that have passed over one's head, but upon the number of colds that have passed through one's head. The best medical opinion supports the view that colds, however minor may be their temporary effect, are of enough importance to warrant serious painstaking care to avoid contracting them.

There are conflicting opinions regarding the cause of colds and no clearly established view prevails. There is some evidence that colds are infections, presumably produced by micro-organisms although no specific organism has been recognized as the etiologic factor. The bacterial theory assumes that the wide variability in incidence reflects differences in resistance among individual persons and differ-

ences in virulence of the attacking bacteria. According to Webster and Clow,[1] persons free of pneumococci, haemophilus influenzae and streptococcus haemolyticus are in general free of coryza, sore throat, and influenzal and sinus attacks; persons who are occasional or periodic carriers of these organisms may be negative on tests over long healthy periods but generally become positive during or following attacks and subsequently become negative again; finally, persons who are chronic carriers show during these illnesses increasing numbers of organisms in the throat and extension of the organisms to the nose. The authors made an addition to the knowledge of the mode of spread of these organisms. A focus of growth and dissemination was determined in the nasal passages and throat of individuals with chronic disease of the upper respiratory tract, and increases in numbers of the organisms at the focus and their spread to contacts were related to the winter season and to the occurrence of symptoms in the carrier. The observations suggest that the dosage of these organisms in a community is controlled by the resistance of the carrier and of the contacts. This view is in agreement with the facts derived from studies of native animal infections. Shibley, Mills, and Dochez[2] report that the contagious cold in human beings is caused by an invisible, uncultivable, filtrable agent which doubtless belongs to the groups of submicroscopic viruses. These seem to have the power to incite activity of the more dangerous pathogenic organisms that infest the upper respiratory tract.

Colds occur more frequently in cold weather but this may not be a cause and effect relationship; it may reflect different living habits in winter than in summer. Smiley in his studies at Cornell denies that cold baths, loss of sleep, drafts, kind of underwear worn, or mouth breathing are factors in catching cold. Barrows at Stanford found that sleeping room conditions of students were not significant; they caught colds just as easily when they slept on a sleeping porch, in a well-ventilated room, or in a poorly ventilated

[1] *Journal American Medical Association*, May 21, 1932, p. 1840.
[2] *Ibid.*, November 22, 1930, p. 1555. Also: December 13, 1930, p. 1837.

room. Moreover, persons coming to California from other climates caught colds just as readily in California as they did at home.

Many persons are susceptible to colds because of abnormality in the nose or throat. The common forms are adenoids, enlarged tonsils, and nasal obstruction. Nasal obstruction may be due to growths, nasal injuries and septal deformities, or to abnormal development of the teeth and palate in childhood. Adenoid growths and tonsils are fre-

Fig. 100.—The shaded areas show the location of the nasal bones and cartilages and important sinuses: A, frontal sinus; B, nasal bones; C, nasal cartilages; D, alar cartilages; E, antrum of Highmore. (Campbell.)

quently the cause of colds in children. All of these abnormalities increase the liability to colds, and, in addition, render it more likely that serious involvement of accessory structures will occur. Thus, middle-ear disease, sinus trouble (Fig. 100), and even the dreaded mastoid infection, may result. It is desirable to have the nasal passages in normal condition for the work they have to do and it seems wise therefore to have abnormalities corrected.

Experiments upon animals show that chilling and over-

eating do diminish the body's resistance to infection. Rabbits which have been chilled subsequent to inoculation with cold-producing bacteria show a higher rate of mortality from the disease than animals similarly inoculated, but not chilled. The old belief that drafts cause colds may be justified in the sense that they congest the mucous membranes.[1] This point needs examination though, because by rational health habits the skin may be trained to adjust readily to all the usual variations in air movement and temperature. This training is important. Cold baths for some persons seem to be an important procedure for skin training. Those not able to take the cold bath may wash the neck and face with cold water every morning and splash some cold water over the chest. This may be helpful.

Getting the feet wet should be avoided whenever possible. If it cannot be avoided, the changing of shoes and stockings as soon as possible is, of course, imperative. Standing out-of-doors in cold weather may result in chilling of the body even though warmly clothed. To avoid this one should—if to be out-of-doors is essential at that time—continuously contract the body muscles. Rising on the toes, shifting the weight, contracting arm and back muscles will be found efficacious.

Dietary indiscretions and constipation lower the resistance to colds. Overeating is to be avoided for this as well as for other good reasons. Constipation is to be combated, of course, with every proper food, and other natural means, such as exercise, plenty of water, and regularity in evacuation. Cheney has proposed the theory that colds reflect a general metabolic disturbance of the organism with a decrease in the alkaline reserve of the blood. He explains the increased frequency in winter as an expression of increased food consumption particularly of proteins and decreased physical exercise. This view has gained considerable acceptance in recent years.

Shall a nasal douche be used? Are vaccines valuable in preventing or treating colds? What home remedies are

[1] Winslow, C.-E. A., and Greenburg, L.: Vasomotor Reactions to Localized Drafts, *American Journal of Hygiene*, January, 1932.

recommended? These are common questions from those who suffer from colds. In general, nasal douches are not advisable. They should be used only on prescription. The snuffing of solutions into the nose is dangerous, and may lead to middle-ear infection. For the same reason care in blowing the nose should be taken by closing one side completely and blowing through the other, allowing the front opening to be unobstructed. Vaccines have been recommended for sufferers from continual colds, and in some cases the results have been good. Chlorine gas has been used[1] in the treatment of colds and other respiratory disturbances. These procedures are not well enough established to give them general approval.

The usual home treatment of a cold is, briefly: Stimulate the bowels by a laxative, preferably a salt, such as magnesium sulfate or citrate of magnesia, and go to bed, keeping the body warm. Ventilate the room thoroughly. A hot foot bath for fifteen to twenty minutes is good treatment, but the danger of catching cold after emerging from the body bath is so great that, if used, it should be supervised carefully.

If treatment is based upon the Cheney theory then the rationale is the administration of sodium bicarbonate. Some persons follow this method, or modify it by drinking a quart or more of orange juice.

If one has over 100 degrees of temperature a physician should be called. The onset of other and more serious diseases is marked at times by the symptoms of an ordinary cold.

After a cold has passed one should not take on work too early. Put the load on gradually. Learn from one experience, and by improving the living routine make succeeding infections, if not impossible, at least, exceedingly difficult.

Tonsils.—The tonsils are glands placed on either side of the opening from the mouth into the pharynx. In childhood they probably serve to protect the individual against respiratory diseases, but if normal they disappear soon after puberty. As a matter of fact, the prime purpose of the

[1] Vedder, E. B., and Sawyer, H. P.: Chlorine as a Therapeutic Agent in Certain Respiratory Diseases, *Journal American Medical Association*, March 8, 1924, p. 764.

tonsils has never been determined. If the tonsils become diseased, then the question is, not what function do they have, but rather, how serious is the infection, and what will happen if they are not removed. There are many old-fashioned beliefs about the tonsils, but they must give way before the clearly proved evidence of tonsil complicity in heart and rheumatism affections.

The entrance for the organisms causing valvular disease of the heart or rheumatism is via the tonsils in many cases. This evidence has been available from clinical experience; it has been corroborated by laboratory findings. The case is complete. Diseased tonsils are dangerous to health!

The present-day operative procedure for the removal of infected tonsils is correct. It is important to have a skilled surgeon perform the operation. There is no danger to be feared if the operation is in the hands of a skilled performer, and if there are no contraindications. The removal of the tonsils enlarges the throat-mouth cavity and increases the volume and resonance of the voice.

Children have large tonsils. These glands decrease in size with age. If not infected they will become very small. The size of the tonsils is not an indication for removal unless they cause obstruction. Real signs of disease and infection will be sought by the reputable and skilled surgeon before advising removal (see Chapter XIV).

Adenoids.—At the opening of the nasal cavities into the upper part of the pharynx there occurs in children a growth of lymphoid tissue, called adenoids (Fig. 51). This growth may become so extensive as to cause interference with nasal breathing, obstruction of the eustachian tube orifice, and hence interference with hearing. The tonsils are to be removed not because they are large, but because they are diseased; the adenoids are rarely diseased, but are dangerous to health because of enlargement. The effects of adenoids are diminished physical activity, lack of energy, vigor and vitality, and malnutrition. They constitute a serious health handicap for the child. In addition, by causing mouth breathing, they produce a lack of proper development of the bones of the nose, cheek, and jaws. The operation is simple,

not dangerous, and should be advised and followed if indicated.

The Joint Committee on Health Problems in Education[1] gives the following structural, functional, and general effects of adenoids:

(*a*) Structural effects:
1. High arched palate.
2. Narrowing of upper jaw.
3. Deformity of chest, resulting from obstructed and imperfect breathing, shown by lateral depression of front of chest and prominent sternum (breast bone).
4. Disturbed development of teeth and vocal organs.
5. Large tonsils in one third of cases.

(*b*) Functional disturbances:
1. Mental:
   (*a*) Disturbance in function of brain resulting in *aprosexia nasalis*, that is, difficulty in forming an idea of anything new; stupidity; difficulty in retaining ideas; weakness of memory; inability to turn thought on a definite subject; lack of power of attention.
   (*b*) Irritability, depression, and often disorderly conduct.
2. Deafness.
3. Defects in sense of smell and taste.
4. Defects in voice (nasal voice).
5. Chronic rhinopharyngeal catarrh, shown by a persistent nasal discharge. This is often one of the first symptoms. In very young children it is manifested by snuffles.
6. Obstruction of air passages resulting in breathing disturbances, manifested by open mouth and great restlessness at night, the child being forced to assume various attitudes, such as sleeping on face, in order to breathe better.
7. Reflex:
   (*a*) Catarrhal spasm of larynx, or croup.
   (*b*) Headache.
   (*c*) Intractable cough and hoarseness.
   (*d*) Bronchial asthma.
   (*e*) Enuresis (incontinence of urine).

(*c*) General effects:
1. Malnutrition and anemia.
2. Underdevelopment, physical and mental.
3. Predisposition to otitis media (middle-ear disease), laryngitis, colds of a remittent nature; increased susceptibility to disease infections, such as tuberculosis, diphtheria, scarlet fever, etc.

[1] Joint Committee on Health Problems in Education of the National Council of Education, National Education Association and the Council on Health, American Medical Association. Health Essentials for Rural School Children, second edition, 1921.

Hygiene of the Voice.—Proper use and care of the voice are very important. A pleasing voice is an asset of real worth to a person. Children develop the voice according to the voices heard most often. The influence of parents and teachers upon voice formation in the child is more powerful than any other factor in determining the quality of the voice. The child that hears harsh, coarse speech will develop like vocal qualities, and the child hearing soft resonant tones will speak softly and resonantly if not prevented by defects in the nose or throat, or by disturbances due to poor coordination in speech control. Adenoids, tonsils, abnormalities of the palate, obstruction in the nose are the common causes of poor vocal sounds. These conditions must be remedied before improvement in speech is to be expected. After abnormalities are corrected, speech training may be necessary to develop new coordinations and to reeducate the muscles of the throat.

Training of the voice may be accomplished either by teachers of oral expression or by teachers of singing. Both forms of training are valuable if good methods are followed. The methods of teaching the use of the voice are indeed numerous. No principles can be stated that will serve effectively in choosing proper teachers; results alone can determine.

The care of the voice is more important to professional singers and speakers, but for all persons the voice is so useful, so much a part of living, that certain rules of hygiene should be noted and followed.

The voice responds to general bodily states. Weakness and muscular flabbiness cannot support a good voice. The voice takes on the quality of the body in general as regards its health. A person in poor health will suffer with fatigue of the voice, and under use there will develop inflammatory conditions, leading frequently to repeated colds in the larynx, called laryngitis. The voice during an attack of laryngitis must not be used more than is absolutely necessary. Singing at such times is especially harmful. Perfect rest for the voice is the best form of treatment for laryngitis.

A frequent cause of poor vocal production is poor posture.

A relaxed, drooping position of the trunk and head allows the larynx to sink and results in poor tones. The basis for good sound production is an erect posture with the abdomen well supported by muscular contraction and the chest carried high. A strained position is not desired, but rather one of erectness and balance.

Smoking causes irritation and thickening of the mucous membrane of the throat and may result in a chronic cough. Improper voice placement may so strain the cords that the singing voice is entirely lost. The efforts of altos to sing soprano, and of baritones to sing tenor lead logically to

Fig. 101.—Tubercle bacilli in phthisical sputum appear in this illustration as small black rods. (Beck.)

disturbance. The voice must be used properly to serve adequately.

Tuberculosis.—A variety of disease processes may develop in the respiratory system. Bronchitis, pneumonia, pleurisy, empyema, and others are all important. Some of these will be discussed briefly in Chapter XIII. Pulmonary tuberculosis is so prevalent and its effects are so disastrous at times, that it is important to describe the disease at length, its mode of transmission, its prevention, and its treatment.

Tuberculosis is an infection caused by the *Bacillus tuberculosis* (Fig. 101). This bacterium may attack almost any

organ in the body. There may be tuberculosis of the lungs, liver, spleen, intestines, kidney, bones, brain, and other structures. In children it is more commonly seen in bone and gland infection; in adults it is more frequent in the lungs.

The cold-blooded animals are rarely affected. It is not uncommon in birds, particularly fowls, but occurs rarely in horses, sheep, goats, cats, and dogs. It is a common disease among cattle, and its widespread prevalence among milch cows accounts in part for many cases of the bovine type in man.

In man the disease is one of the most serious from an economic and social point of view. It is estimated that one seventh of all deaths in England and one ninth of all deaths in the United States are due to the disease.

The disease attacks all ages and both sexes. In the Massachusetts study of 200,000 children the tuberculin test was positive in 28 out of each 100 children between five and fifteen years of age. About 1 per cent showed the disease sufficiently advanced to require continued medical attention. The disease among college and professional students is quite generally neglected.[1]

Causes of the Disease.—The disease is caused by a minute bacterium that is able to grow and develop in the body under favorable conditions. Two things are necessary: the organisms, and a condition favorable to their growth and development. In this respect it is helpful to think of these essentials in the light of Osler's famous analogy, and consider the nature of the seeds (bacteria) and the soil (the human host).

The Seeds.—The bacteria are scattered widely among human habitations. The two chief sources are: The expectoration of persons with advanced disease of the lungs, and the milk of tuberculous cows.

There are other sources probably derived from the former. Scores of experiments have demonstrated the presence of bacilli in samples of dust from public buildings, streets, railway coaches, traction cars, etc. These bacilli are so

[1] Long, E. R.: Tuberculosis in University Students, *Journal of the Outdoor Life*, November, 1933, p. 383.

ubiquitous that in cities, at least, few individuals pass a week without coming in contact with them and affording an opportunity for their lodgment in the respiratory passages. From the street the bacilli may be brought into the house on the shoes, the skirts of women, the hair of cats and dogs, and in the dust of the air. The tubercle bacilli of the bovine type are usually distributed by the milk of tuberculous cows. Park has shown that from 6 to 10 per cent of the deaths in children with tuberculosis was of the bovine type, thus indicating the supreme importance of using for dairy purposes only those cows that are tuberculin tested and shown to be free from tuberculosis.

The Soil.—It is a very interesting and highly instructive fact that approximately 90 per cent of all people are at some time infected with the tubercle bacillus. This is instructive especially because a very much smaller percentage die of the disease. The health of the body, *i. e.*, resistance to disease, is a prominent factor in the case. Osler's[1] famous analogy of the Parable of the Sower is interesting:

"Some seeds fell by the wayside and the fowls of the air came and devoured them up." These are the tubercle bacilli scattered widely over the human environment, the majority of which die. "Some fell upon stony places." These are the ones that find lodgment in many persons, but they do not develop because "they have no root." "Some fell among thorns and the thorns sprang up and choked them." This represents the bacilli that find suitable body soil for growth, but the thorns, representing the protecting forces of the body, get the better of the struggle.

"But others fell on good ground and sprang up and bore fruit an hundred fold." This is the group that produces one ninth of all deaths in the United States, and that costs about $200,000,000 annually; that brings sorrow and suffering to thousands and ruins the plans and purposes of many lives. To know what makes the soil favorable for the development of the seeds is very important.

Predisposing Factors.—1. *Environment.*—It is true that

[1] Osler, W.: The Principles and Practice of Medicine, D. Appleton & Co., New York, 1912, p. 157.

one can acquire a predisposition to the disease. Dwellers in the cities in dark alleys and tenement houses, workers in cellars and ill-ventilated rooms, and persons addicted to drink are very prone to the disease. Dr. Trudeau demonstrated the effect of environment when he showed that rabbits, inoculated with tubercle bacilli, if confined in a dark, damp place, without sunlight and fresh air, rapidly succumbed, while others inoculated in the same way, but allowed to run wild, recovered or showed very slight lesions. In this connection it is instructive to note that occupants of prisons, asylums, and poor-houses, and large unsanitary factories respond like Trudeau's rabbits in the cellar. Environment is a factor of first-rate importance, and the social and economic conditions creating unfavorable environment are at the crux of the problem. The kind of people most likely to get tuberculosis are those whose environment is favorable for the bacillus.

An important factor in environment is occupation. The work one does is restricted to place and surroundings. Hence the death rate from tuberculosis, classed by occupation, is significant of the influence in the environment of the work done and conditions of labor. Table IX, given below

TABLE IX

DEATHS FROM TUBERCULOSIS BY OCCUPATION AND PLACE

	Baltimore.	D. C.	New York.	Brooklyn.	Philadelphia.	Boston.	Average of the cities.
Printers and pressmen	429	342	437	370	377	430	398
Female teachers in schools	452	395	272	336	441	477	396
Stonecutters	432	333	398	423	261	496	391
Dressmakers and seamstresses	396	386	385	350	405	388	385
Saloon keepers and bartenders	213	305	296	295	223	276	268
Policemen, watchmen, detectives	183	187	190	169	161	113	167
Farmers, planters, overseers	141	175	207	128	103	83	139
Lawyers	119	125	102	236	139	96	130
Physicians and surgeons	204	103	120	113	135	90	128
Clergymen	138	120	153	91	140	83	121

showing deaths from tuberculosis per 1000 deaths from all causes, prepared by Oldright and presented by Terman,[1] is instructive.

Tuberculosis mortality by states is shown in Fig. 102. The high rate in western and southwestern states is incident to the fact of migration of tuberculous cases to these places. Note the high rate in Kentucky and Tennessee.

2. *Heredity.*—It was very common some years ago to hear of the importance of heredity in the acquirement of tuber-

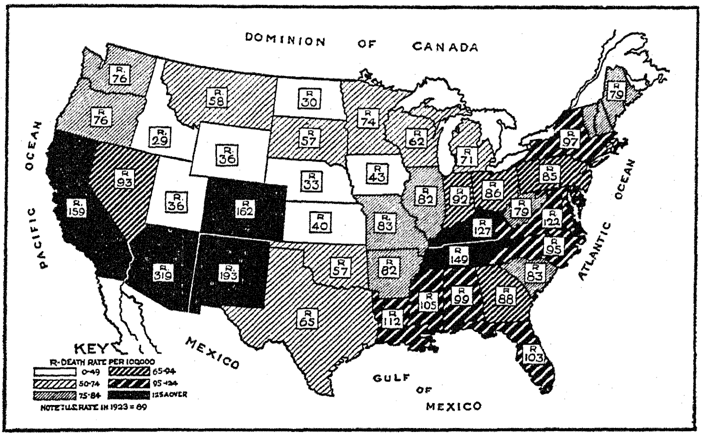

Fig. 102.—Tuberculosis mortality in the States, 1923. This chart should be interpreted in terms of the fact of migration of tuberculous cases to favorable climates. (Modified from Drolet's Reference Handbook of the Vital Statistics of New York City.)

culosis. Today there is no general acceptance at all that tuberculosis is inherited biologically; the term "tendency" is used to indicate that children of tuberculous parents are more likely to acquire the disease, because there is an inherited weakness or susceptibility. There is considerable reason for believing the "tendency" theory. It is true that children of tuberculous parents are often weak and malnourished, but the important thing to remember is that these

[1] Terman, L. M.: The Teacher's Health, Houghton Mifflin Co., Boston, 1913, pp. 24, 25.

children inherit tuberculous parents, that they come into a home where tuberculosis is active. In short, heredity in this disease is of very little importance; environment, on the contrary, is exceedingly significant.

3. *Race.*—That individuals may inherit a weakness to the disease is well illustrated by the fact of racial susceptibility. Negroes are very prone to the disease, and the American Indian since his civilization has succumbed in large numbers. The Irish are very susceptible; the Jews very resistant.[1]

4. *Sex.*—Women have a lower mortality than men with the exception noted below of young women in recent years.

5. *Habits of Life.*—Aside from environmental factors, such as light, air, and general surroundings, there are personal factors that tend to make the soil favorable for the development of tuberculosis. These may be briefly summarized under several headings:

(*a*) *Overwork.*—Fatigue of the body resulting from too long hours of labor or lack of sufficient rest, reduces bodily resistance and favors the development of tuberculosis.

(*b*) *Improper Food.*—Malnutrition with the resulting devitalization of the body presents an unusual danger in this connection. This is especially true for children who eat insufficient eggs, milk, green vegetables, and meat.

(*c*) *Lack of Outdoor Air and Exercise.*—It has often been shown that outdoor air and exercise have direct effect upon the production of hemoglobin and increase of leukocytes in the blood. The general wholesome effect upon all the functions of the body is well known; the lack of these factors leaves the body weak and ineffectual and offers a ready soil for tuberculosis.

Knopf calls[2] attention to the relatively greater mortality from tuberculosis among young girls between sixteen and nineteen as compared with boys of the same age. He reports that for the first time in the history of the Wisconsin Tuberculosis Association all the state's twenty sanatoriums are filled with patients, with long waiting lists at many of them; the situation being due to the increase of tuberculosis among young women. In the year 1926 in New York City there died from all forms of tuberculosis 257 girls and 139

[1] Dublin, L. I.: *Scientific Monthly,* January, 1922, pp. 94–104.

[2] Knopf, S. A.: Tuberculosis among Young Women, *Journal American Medical Association,* February 18, 1928.

boys between the ages of fifteen and twenty. Between the ages of twenty and twenty-five, 369 women to 293 men.

Greene reports similar figures for Cleveland, and notes the death rates for the male and female between fifteen and twenty-five years are much the same up to the year 1918, but since that time the male death rate has decreased much more rapidly than the female death rate.

The increased mortality among girls has been ascribed to the flimsy modern dress. It is believed by some that the mortality from tuberculosis would be cut if dress reform could be encouraged. Dr. Knopf agrees with this position, but presents other reasons in addition. He mentions first the almost insane desire of so many girls to have a slender figure. Many of these have voluntarily starved themselves to attain a form that was fashionable. To the flimsy dress should be added the tightly laced brassiere adjusted over the breast to increase the boyish appearance. Excessive cigarette smoking[1] and insufficient sleep because of too much night life are regarded also as contributing factors in the development of tuberculosis.

Prevention.—It has been through the employment of scientific treatment and wide educational preventive measures that the trend of the death rate has been directed downward. The problem of prevention is two-fold—personal and social. It relates, on the one hand, to adequate care of the personal health, and on the other to intelligent social effort to provide sanitary conditions for others. This disease in relation to health illustrates in a striking way that hygiene can never be an academic or cultural subject. It is only of significance and meaning as it is lived. It illustrates also that as regards attitudes, the one fostering a sense of social responsibility is of the first and foremost importance even for those who are selfish, primitive, and instinctive.

1. *Personal Prevention.*—The problem here is keeping one's health at the highest possible level. For one with the tendency or exposed directly to the disease, this is of

[1] Freudenthal, Wolff: Tobacco: Its Relation to the Upper Respiratory Tract, *Laryngoscope*, March, 1927.

paramount importance. This means prevention of fatigue, eating proper food, securing adequate hours and conditions of sleep, and avoidance of insanitary conditions of work in factory or home.

2. *Social Prevention.*—Clearly this measure is the more important, and if achieved with reasonable success it will accomplish for all what a personal program could not hope to secure alone. There must be at least six parts to this program:

Fig. 103.—A porch group enjoying outdoor air, sunshine, and rest. Note the happy faces. (Courtesy National Tuberculosis Association.)

1. Education of the public, and especially the tuberculous, in the nature, course, prevention, and treatment of the disease.
2. Legislation that places tuberculosis on the list of reportable diseases.
3. Improvement of the housing conditions of the poor and of the working conditions in all industries not satisfactory.
4. State or municipal legislation and control relating to the milk supply, food supply; cleanliness of streets, sleeping cars, and public places; enforcement of the ordinances against spitting.
5. Adequate hospital and sanatorium facilities to care for those who have the disease. (Fig. 103.)
6. Prevention of other diseases especially predisposing, such as, in children:
   (*a*) Measles, which is frequently followed by pulmonary tuberculosis, and
   (*b*) Whooping cough, which predisposes to tuberculosis.

Treatment.—It is very instructive in connection with this disease that nature provides a cure frequently, if the individual will early return to the course that nature asks of all who wish to live well. The treatment is not by medicines, but by

1. Outdoor air and sunshine,
2. Nourishing food, and
3. Rest.

The importance of early recognition is very great. It can be said with considerable assurance that early cases will recover if given the above treatment. Late cases are often hopeless. There should be keen appreciation of the value of medical examination of school children, workmen, and college students everywhere.

The question of treatment cannot be dismissed without warning against the vultures who prey upon the victim of tuberculosis. Fake cures, false claims, all sorts of devices purporting to cure by radium emanations, electricity, or oxygen are widely advertised.

Vaccines[1] are used at times in the treatment of the disease. They are likely to be of greatest value when used by a specialist experienced in the use of tuberculin. The Mantoux test is a valuable diagnostic test. The old Calmette test for the diagnosis of tuberculosis is not to be used; and it would be strange to find a modern physician using it as a diagnostic test.

Some cases of tuberculosis are treated surgically. This is especially valuable for lung cases that can be helped by artificial pneumothorax.

QUESTIONS AND EXERCISES

1. State briefly the essentials of respiration.
2. List three essentials to good ventilation.
3. Summarize briefly the conclusions of the New York Commission on Ventilation.
4. What type of ventilation seems to be best? What is the desirable temperature for indoor air?
5. What are the characteristics of a healthful climate?

[1] Vaccine therapy is not used so frequently today because of the liability to anaphylaxis (developed sensitivity to foreign proteins).

6. What are the effects of sharp variations in temperature on the body?
7. What methods may be used to maintain desirable humidity in the school room?
8. State the effect of wind on metabolism. State the effect of humidity on metabolism.
9. Of what value is dust in the air?
10. What conditions render bacteria in the air injurious?
11. State the health values of sunshine.
12. What factors in cities operate to deprive citizens of the healthful sun's rays? How may such factors be combated?
13. State dangers of exposure of the body to sunshine.
14. Explain the automatic control of respiration.
15. Summarize the recent scientific findings with reference to breathing exercises.
16. List factors upon which the health of the respiratory system depend.
17. Mention some ways of preventing colds. Why are there several methods of cold prevention?
18. State effects which may result from diseased tonsils and adenoids.
19. State important points in voice hygiene.
20. What are the predisposing factors in the occurrence of tuberculosis?
21. Describe the influence of environment, heredity, race, sex, and habits of life in the production of tuberculosis.
22. State reasons for the increase of tuberculosis in young women, fifteen to twenty-five years of age.
23. What is the treatment for tuberculosis?

CHAPTER IX

HYGIENE OF THE CIRCULATORY SYSTEM

I. Anatomical and Physiological Backgrounds.
II. The Heart:
  1. Remnants of the Fetal Heart.
  2. How the Heart Works.
  3. The Force and Rate of the Heart Beat.
  4. Blood Pressure.
III. The Blood:
  1. Red Blood Cells.
  2. White Blood Cells.
  3. Platelets.
IV. The Vessels:
  1. Arteries.
  2. Veins.
  3. Lymphatics.
V. The Importance of the Circulation:
  1. The Increase in Circulatory Disease.
  2. Red Blood Cells.
  3. White Blood Cells.
  4. Plasma.
VI. The Vessels:
  1. The Arteries.
  2. The Veins.
  3. Varicose Veins.
VII. The Heart:
VIII. The Convalescent Heart.
IX. The Influence of Poisons upon the Heart.
X. The Influence of Tobacco.
  1. The Nicotine Content of Tobacco.
  2. A Need for Accuracy.
  3. General Effects of Tobacco.
  4. The Effects of Tobacco upon Youth.
  5. Tobacco and the Sexes.

Anatomical and Physiological Backgrounds.—To watch the circulating blood in the web of a frog's foot, to see the contracting heart of a man in a fluoroscopic picture, to observe the clotting of blood and the separation of the plasma are wonderful glimpses of Nature's marvelous provision for life processes. In a book the study of the circulation is a prosaic affair compared to the ebb and flow of its tide in the living organism.

A rather helpful analogy may be drawn between the circulation of the blood and the water supply system of a city. A water system is composed of powerful pumps, water mains, and the water. The circulation in man comprises also three main divisions: a pump, the heart; a system of

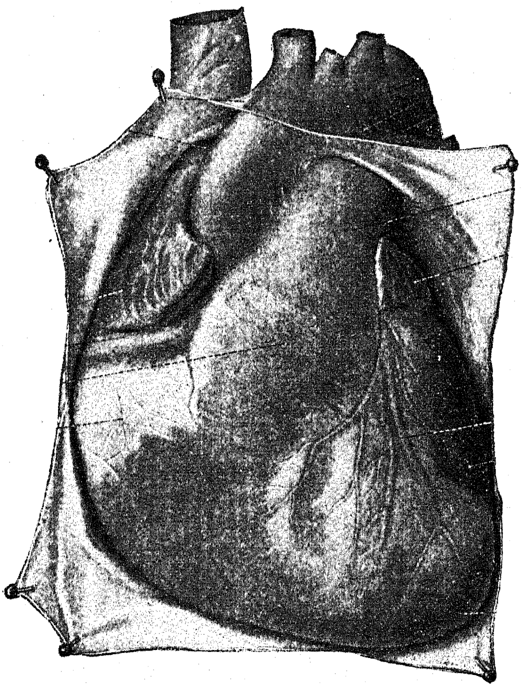

Fig. 104.—The heart enclosed in the pericardium, seen from in front. The pericardium has been opened in front. Notice the large vessels above and the vessels of the heart itself. (Sobotta and McMurrich.)

tubes, the vessels; and a circulating fluid, the blood. The countless number of details regarding the structure and function of the many parts would fill a good-sized book, but the essentials may be rather briefly described.

The Pump.—The heart (Fig. 104) is a muscular organ composed of four chambers. It is conical in shape and about

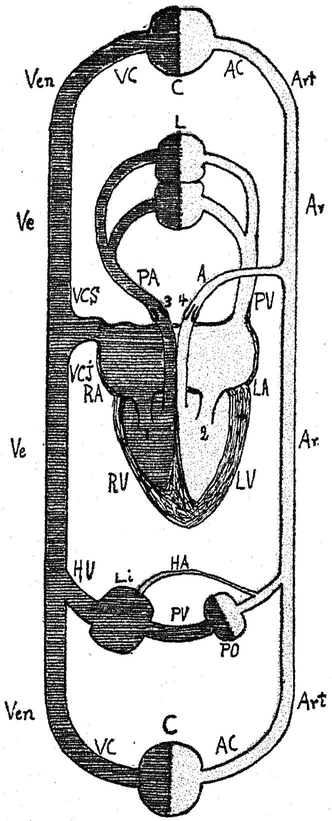

Fig. 105.—Schema of the circulation: *A*, Aorta; *Ar*, arteries; *Art*, arterioles; *AC*, arterial capillaries; *C*, capillaries; *VC*, venous capillaries; *Ven*, venules; *Ve*, veins; *VCS*, vena cava superior; *VCJ*, vena cava inferior; *RA*, right auricle; *RV*, right ventricle; *LA*, left auricle; *LV*, left ventricle; 1, tricuspid valve; 2, mitral valve; 3, pulmonary semilunar valve; 4, aortic semilunar valve; *PA*, pulmonary artery; *L*, lungs; *PV*, pulmonary veins; *PO*, portal organs; *PV*, portal vein; *HA*, hepatic artery; *Li*, liver; *HV*, hepatic vein. (Burton-Opitz.)

the size of the fist. Blood vessels (veins) bring blood to the heart and other vessels (arteries) carry blood from it. A diagram of this plan is shown in Figure 105. The upper

chambers are the auricles; the lower ones the ventricles. There are, then, right auricle and ventricle and left auricle and ventricle.

These chambers are lined with a smooth epithelial membrane called the "endocardium." Between auricle and ventricle on each side is a valve, called on the right the "tricuspid," and on the left the "mitral." At the opening from the ventricles into the aorta, there are also valves called on the right, the "pulmonary semilunar" and on the left the

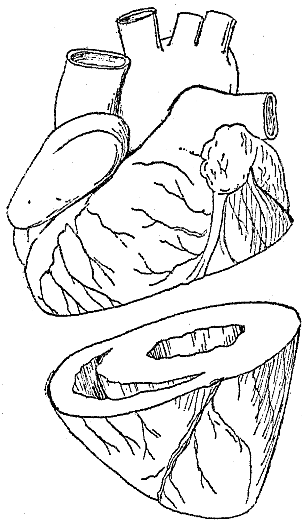

Fig. 106.—A general view of the heart, the ventricles being cut across to show the crescentic form of the right, appearing like an appendage upon the left. (From Stiles "Human Physiology.")

"aortic semilunar." These 4 valves are also covered with endocardium. The term "endocarditis" refers to the inflammation of the endocardium which is especially serious when it occurs on the valves. These delicate membranes may be injured and the integrity of the valve destroyed.

The right ventricle pumps blood through the lungs; the left through the entire body, except lungs. Obviously the left ventricle is stronger and its muscular walls thicker; it

does more work than the right. This difference is indicated in the diagram in Figure 106.

The heart valves are constructed to permit flow in one direction only. It is their destruction or impairment that interferes with this normal function (Fig. 107).

Remnants of the Fetal Heart.—After birth the heart shows some interesting structures that denote the amazing adjustment made by this organ in preparing to take over the responsibility for maintaining a complete circulation.

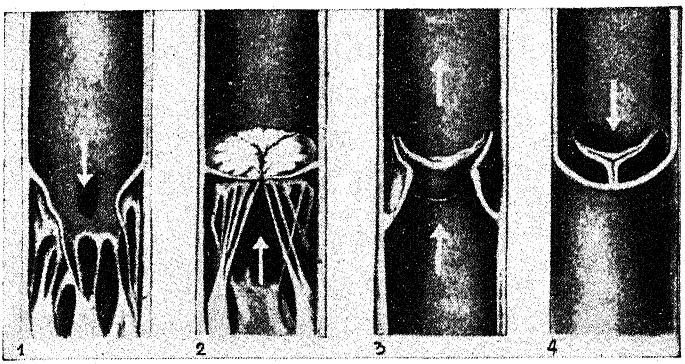

Fig. 107.—Diagram of two valves of the heart showing their action. 1, Tricuspid valve open, blood flowing from right auricle into right ventricle. 2, Tricuspid valve closed by the filling of the ventricle and floating up to closed position of the valve flaps. Note that the cords attached below prevent the valve from being pushed into the auricle by the pressure below when the ventricle contracts. 3, Pulmonary semilunar open, blood flow from right ventricle to lungs. 4, The semilunar closed, preventing blood flowing back into the ventricle during its period of diastole. (From *Viva Cien Años.*)

While in the uterus, the fetus does not breathe, and hence there is no need for blood in the lungs; the oxygen needs of the fetus are met by the maternal blood.

The normal route of the blood is right auricle, right ventricle, then via pulmonary artery to the lungs. In fetal life, however, most of the blood coming into the right auricle is shunted by means of a shelf in the wall of the auricle to the left auricle by means of an opening, the foramen ovale, between these two chambers. Blood that escapes this by-pass

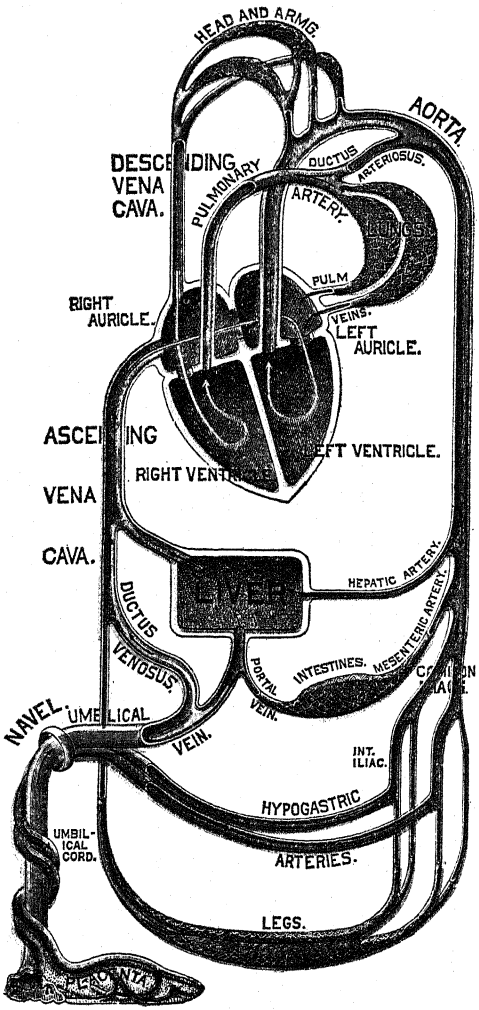

Fig. 108.—Diagram of fetal circulation before birth; the arrows indicate the course of the blood current; the colors show the character of the blood carried by the different vessels. (Amer. Text-book of Obstetrics.)

enters the right ventricle and leaves by the pulmonary artery. Now another by-pass (ductus arteriosus), an artery from the pulmonary tube to the aorta, turns this stream from the lungs into that of general circulation (Fig. 108).

At birth the foramen ovale closes and the arterial duct collapses. In later years, the site of the foramen is marked by a depression in the wall between the two auricles, and the arterial duct remains as a simple band of tissue—silent testimony of one of the most remarkable examples of adaptation of structure to meet functional needs.

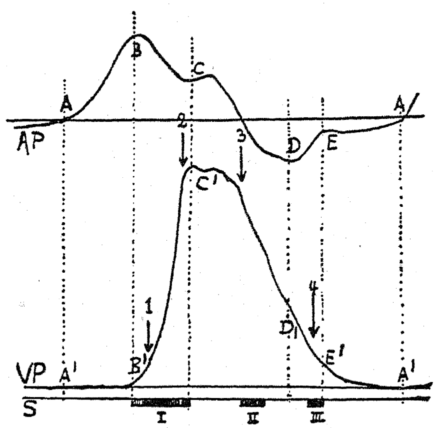

Fig. 109.—Curves of pressure in the auricle and ventricle. Note that auricular systole ends at B and ventricular systole begins at B[1]. The arrows mark the opening and closing of heart valves. I, II, and III indicate the first, second, and third heart sounds. (Burton-Opitz.)

How the Heart Works.—The heart is a muscle and it is muscular contraction that explains how the heart pumps blood. When the heart contracts the heart chambers are reduced in size, the pressure upon the contained blood forces open the valves, and the blood squirts from the ventricles.

The contraction of the heart is rhythmical. It passes as a wave over the auricles and ventricles. After the contraction wave there is relaxation, the chambers fill with blood, and the process is repeated. The contraction phase of the heart is called "systole"; the relaxation phase "diastole."

Systole begins at a point near the junction of a large vein that enters the right auricle. The vein is the superior vena cava, and the point of beginning contraction is called the "sino-auricular node." The contraction wave starting at this node travels over the auricles producing an emptying of blood into the ventricles. When the wave reaches the ventricle, it is carried by a special bundle of fibers to the muscle cells of the ventricles and these contract then in harmony with the wave that has passed over the auricles. During ventricular systole, the auricles have started their diastole and blood from the veins is entering these chambers. These relationships can be easily learned by reference to the diagram in Figure 109, in which the up-stroke represents systole and the down-stroke diastole.

The Force and Rate of the Heart Beat.—When the individual engages in vigorous exercise the force and rate of the heart beat are increased. The ready adaptability of the heart to needs of the organism for more blood may be so efficient that the volume of blood discharged during severe exercise may be ten times that given out in a sedentary state. This increase results from increased heart force and increased rate of contraction. The former is accomplished by a dilatation of the heart with resulting greater force exerted upon an increased amount of blood in the ventricles; the latter is the result of excitation of the heart by reflex impulse over the nerves to the heart.

The normal heart rate is given by Burton-Opitz as follows:

At birth	140	Youth	90
Infancy	120	Adult	75
Childhood	100	Old age	70

Blood Pressure.—The flow of blood from the heart throughout the elaborate system of tubes encounters resistance and it requires pressure to overcome this. This pressure is given basically by the heart. There are factors in the vessels themselves that alter the pressure, but basically blood pressure represents the pressure of blood within the vessels occasioned by a force from behind and a resistance ahead.

The pressure is measured by an instrument called "sphyg-

momanometer" (Fig. 110). Determination of blood pressure is important as an aid in detection of disturbances to health. The instrument is used chiefly by physicians.

Blood pressure varies considerably with age, sex, time of day, fatigue, and exercise. It is increased sharply with exercise. This corresponds with what was learned regarding the increased force of the heart in severe exercise. In health, the blood pressure rather quickly returns to normal after

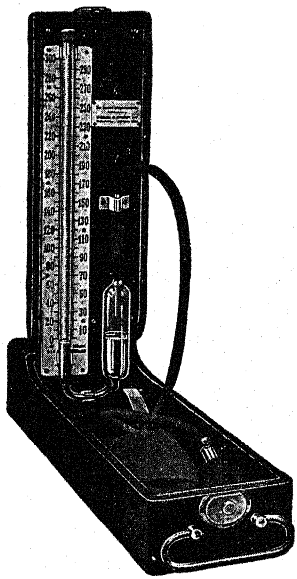

Fig. 110.—Sphygmomanometer of recent construction. (Manufactured by Green and Bauer.)

cessation of the exercise. This fact is sometimes used in testing heart efficiency.

The Blood.—The blood volume is about one-tenth of the weight of the body. If an individual weighs 140 pounds, 14 of the 140 are blood. One may lose one-fourth of the blood and live, but just what percentage loss may be borne by the healthy individual without fatal results has not been determined definitely. Howell states that loss equal to 3 per

cent of the body weight may be borne. If severe hemorrhage has occurred immediate transfusion is desirable. After hemorrhage the plasma is rapidly restored, but it takes considerable time to recover the cellular elements. The composition of the blood is indicated in the following outline:

TABLE X

COMPOSITION OF THE BLOOD

- BLOOD
  - Cells
    - Red Blood-cells
    - White Blood-cells
      - Leukocytes
      - Lymphocytes
    - Platelets
  - Plasma
    - Water
    - Gases
      - Oxygen
      - Carbon dioxide
      - Nitrogen
    - Food-stuffs
      - Carbohydrates—Glucose
      - Fat—Fatty acids
      - Protein
        - Serum albumin
        - Serum globulin
        - Fibrinogen
    - Salts
      - Chlorides
      - Carbonates
      - Sulphates
      - Phosphates
      - Silicates
      - of
        - Calcium
        - Sodium
        - Magnesium
        - Potassium
        - Iron
    - Protective substances
      - Opsonins
      - Agglutinins
      - Bacteriolysins
    - Autacoids—Internal secretions from ductless glands.
    - Waste substances
      - urea
      - uric acid
      - creatin
      - xanthin
      - hypoxanthin
      - quannin
      - adenin
      - carnin

Red Blood Cells.—The red cells of the blood are small, circular, disk-shaped bodies. Their small size is shown in the statement: the diameter of one is 7.7 micra (1 micron = 0.001 mm.); it would take about 25,000 micra to make 1 inch. There are 5,000,000 red cells in every cubic millimeter of blood for man and 4,500,000 for women (Fig. 111).

The striking characteristic of the red cell is its content of hemoglobin. When oxygen from the air of the lungs comes in contact with hemoglobin, oxyhemoglobin is formed and in this manner the oxygen is carried to the various cells of

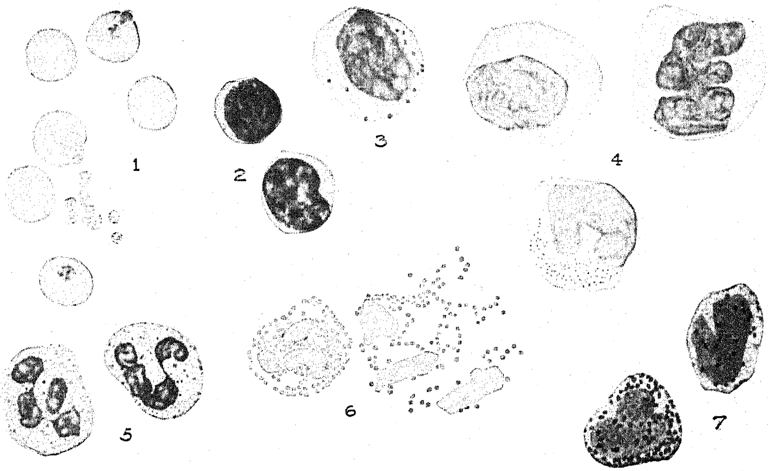

Fig. 111.—Figures 1 to 7 inclusive, the cells of normal blood reproduced from actual cells. Wright's stain (× 1000 : 1 mm. = 1 μ). 1, Red corpuscles and blood platelets; 2, two lymphocytes; 3, a lymphocyte with azurophilic granules. This cell lay in a thin portion of a film and was exceptionally large; 4, three endothelial leukocytes, one with fine cytoplasmic granules. The granules are rarely so distinct as here shown; 5, polymorphonuclear neutrophils; 6, eosinophils, one ruptured. The cells selected for drawing contained fewer granules than are usual; 7, basophils. (Todd and Sanford.)

the body. Reduction in hemoglobin content of the blood may result from decrease in the total number of red cells or from decrease in the percentage of hemoglobin in the normal number of cells, or from both.

White Blood Cells.—The white cells are colorless, nucleated cells extremely variable in shape. The average number for the adult is 7500 per cubic millimeter. The widely varying types of white cells are shown in Figure 111. They have

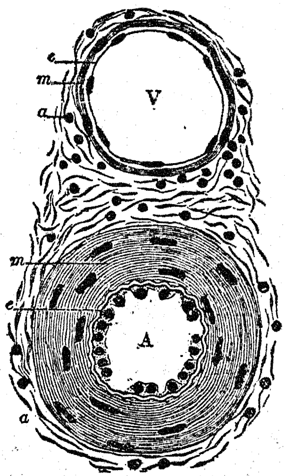

Fig. 112.—Transverse section through a small artery and vein: *A*, Artery, showing the nucleated endothelium; *e*, surrounded by the wavy elastic layer; *m*, circular muscle coat; *a*, bundles of connective tissue fibers; *V*, vein showing similar arrangement. (Klein and Noble Smith.)

different functions, but in the main they are protective to the organism by destroying bacteria. In certain types of infection the number of certain forms increase. To determine this reaction, a blood specimen is required by the physician as an aid to diagnosis of the disease.

Blood Platelets.—These cells are small irregular bodies, smaller than red or white cells. They are supposed to play a rôle in coagulation of blood.

The Vessels.—There are three sets of vessels in the cir-

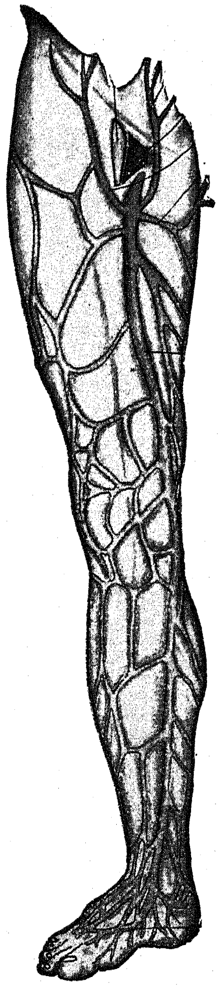

Fig. 113.—The superficial veins on the front aspect of the lower extremity. (Radasch.)

culation, arteries, veins, and lymphatics. These vary greatly in size ranging, for example, from the largest artery,

the aorta, that is 2.7 cm. in diameter to the smallest capillaries that can be seen only with the microscope. All vessels have smooth linings composed of flat cells, similar to those lining the heart chambers.

Arteries.—The arteries contain considerable muscle in their walls (Fig. 112). There is also elastic tissue. Muscle is marked in the small arteries and denotes the function that takes place. These small vessels are capable of contraction and dilation in response to nerve impulses. These phenomena of the arteries are referred to as vasoconstriction and vasodilation, or inclusively as vasomotor.

When the left ventricle thrusts a chamber of blood into the aorta already filled with blood, an impulse is given to the entire body of blood in the arterial system which may be felt in vessels close to the surface as a throb or pulse. The aorta stretches to take up this new addition and then during diastole the elastic recoil of the tube forces on the stream. This arrangement makes for a steady flow of blood interrupted only by these waves or pulsations that correspond to the heart beat.

The Veins.—The veins are much thinner tubes than the arteries; the pressure within them is much less. They begin in the capillaries and are formed by coalescence of small vessels to form larger ones (Fig. 113), until when the heart is reached they have attained considerable size.

The veins of the lower extremities, particularly, and some others contain valves. These are folds of the lining coat of the vessel, arranged in pairs, usually, although a single flap may be formed and at times three flaps make the valve. These open toward the heart and support the blood between two adjoining valves against the force of gravity.

Lymphatics.—An accessory set of vessels not connected with the arterial system at all begins in the spaces between cells and, gathering size by coalescence of smaller vessels, forms larger tubes that empty into the venous circuit just before the heart is reached (Fig. 114).

The lymph in these vessels is not influenced by the heart's force and the flow is sustained by mechanical factors acting upon the outside of the lymphatic walls. Gravity, muscular

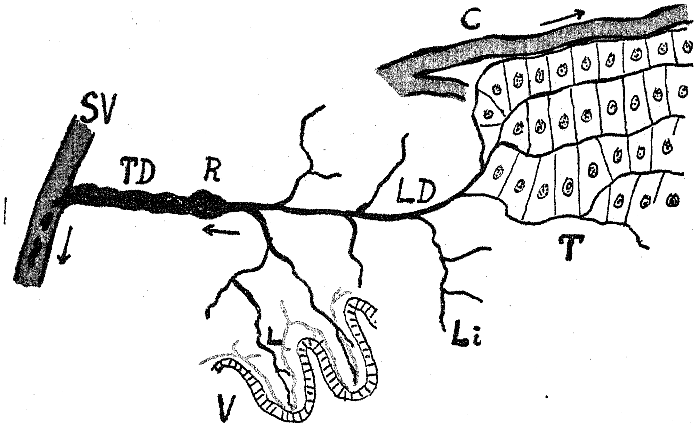

Fig. 114.—Scheme of the circulatory system of the lymph: *C*, Blood capillaries; *T*, tissue cells; *LD*, lymphatics; *L*, lacteals; *V*, villi of intestine; *Li*, liver; *R*, receptacle; *TD*, thoracic duct; *SV*, subclavian vein. (Burton-Opitz.)

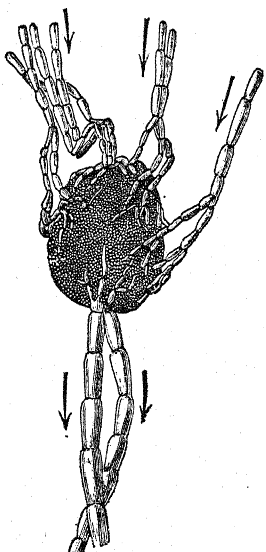

Fig. 115.—A lymph node with its afferent and efferent vessels. (Testut.)

contraction, changes in pressure in various areas—these are chiefly responsible for lymph flow.

Along the course of the lymphatics, especially at joints, lymph glands are arranged (Fig. 115). Through these the lymph passes. They serve as guardians of the circulation by preventing entrance into the blood of bacteria and poisons that may escape from the tissues into the lymph. The glands of an area are inflamed and enlarged when there is an infection of the area drained by the gland due to this effort to protect the circulation.

The Importance of the Circulation.—The circulation of the blood through the body is important because the blood serves to carry to the tissues of the body oxygen from the lungs and foodstuffs from the digestive tract;[1] it carries waste and excess water to the organs of elimination; it assists in the regulation of temperature; and, finally, it is the medium for the transmission of the internal secretions from the ductless glands.

In New York City where special attention has been given to heart disease as a cause of death the increase is very marked. Some of this is probably due to more complete records but that would not explain the continued increase. This increase in deaths from organic heart disease exceeds in New York City the death rate from any of the other leading causes of death. Tuberculosis and cancer are looked upon generally as more serious but heart disease in New York City is more than twice as dangerous to life as cancer and almost exactly three times as dangerous as tuberculosis.

From this statement it follows that the keeping of a good circulation is a most important affair for everyone. This is not generally recognized. The deaths from heart disease are on the increase. At the present time the number of deaths from heart disease exceeds the deaths from tuberculosis.

The economic loss due to impaired circulation is very

[1] Burton-Opitz has shown that an amount of blood equal to the entire amount in the body of a dog traverses the liver every three minutes, *Quarterly Journal of Experimental Physiology*, 1912, p. 189.

great. In addition, children with a handicap of heart disease present a serious problem for parents, the school, and society in general. To prevent heart disease and to maintain a high level of circulatory efficiency are important goals.

The Increase in Circulatory Disease.—We have become accustomed to think of the seriousness of tuberculosis and cancer; the preceding analysis makes heart disease appear truly significant. Statistics show that in the United States since 1890 there has been a steady increase in mortality from diseases of the heart and blood vessels. These are so often found associated with disease of the kidneys that clinicians use the term "cardiovascular-renal disease." By better child care, by improved sanitation, and other public health measures the mortality from the communicable diseases, especially in youth, has been decreased, but the number of persons dying in early adult life is increasing. This increase in deaths due to circulatory disease suggests serious questions concerning the vitality of the people and their habits of living.

Now while the mortality from this cause is increasing in the United States, the expectation of life in the same adult periods is more favorable in England, Wales, Prussia, Sweden, and other European countries. The meaning and significance of this increase in the chronic degenerative disease have been brought out by the Life Extension Institute, Inc., and the cause for this increase expressed by Fisher and Fisk:[1]

CAUSES OF CHRONIC DISEASE, PREMATURE BREAKDOWN, AND PREMATURE DEATH

Heredity.	Mental inactivity.
Infections.	Physical inactivity.
Poisons.	Too much food.
Mental strain.	Too little food.
Physical strain.	Badly balanced diet.

Accidents, injury.

A knowledge of these causes plainly points the way to their control.

[1] Fisher, I., and Fisk, E. L.: How to Live, Funk & Wagnalls Co.. New York, 1921, p. 393.

In a discussion of the heart in middle life, Dr. David Riesman,[1] Professor of Clinical Medicine, University of Pennsylvania, named the following factors:

1. Latent syphilis.
2. Chronic focal infection.
3. Infectious diseases in childhood.
4. Overeating.
5. Tobacco used in excess.
6. Strenuous, overly ambitious living, stress and strain.

In presenting the hygiene of the circulation the discussion will follow the outline of the composition of the blood as given in Table IX, and will conclude with the heart and vessels.

Red Blood Cells.—These cells are important because of a very vital function they perform in carrying oxygen to the tissues from the lungs. They are able to do this by virtue of having in their cell bodies a substance, hemoglobin, which has the property of combining chemically with the oxygen as it passes through the lungs, thus forming oxyhemoglobin. In this form all the oxygen, except a small amount in solution in the plasma is carried to the tissues and is given up to the cells of the body when needed. There is no mechanism for storing up oxygen in the body and as soon as the oxygen leaves the red cell it is used in the oxidation of some food element.

The hemoglobin of the red cell is extremely important. If it is inadequate in amount in the body a condition known as anemia develops. Anemia may result from a decrease in the percentage of hemoglobin in each cell or by a reduction in the total amount in the blood through a diminution in the number of cells. In the one case the cells are usual in number, but contain less than the normal percentage of hemoglobin in each cell; in the other the hemoglobin may be normal in amount in each cell, but the number of cells is reduced, and hence the total amount of hemoglobin in the blood is lessened. Anemia is a very common condition,

[1] Riesman, D.: The Nonvalvular Diseases of the Heart in Middle Life, *Bulletin of the New York Academy of Medicine*, August, 1930, pp. 536–552.

especially in young and growing girls, and it is, therefore, important to determine its causes and prevent its occurrence.

Dr. Cabot[1] gives the causes of anemia as follows:

(*a*) Hemorrhage—gastric, hemorrhoidal, traumatic, puerperal.
(*b*) Malaria, more rarely sepsis or other infections.
(*c*) Malignant disease (cancer).[2]
(*d*) Chronic suppurations (old sores with discharge).
(*e*) Chronic glomerulonephritis (Bright's disease).
(*f*) Cirrhosis of the liver (inflammation and destruction of normal liver cells).
(*g*) Poisons, especially lead.
(*h*) Chronic dysentery.
(*i*) Intestinal parasites.

Now the causes of anemia are well known. In any effort to correct anemia and secure good blood the first step must be to remove the cause of the disturbance. This cannot be done by giving iron or a similar blood "remedy" unless the source of the trouble is removed, *e. g.*, cancer, malaria, intestinal parasites, etc.

It is interesting that Dr. Cabot does not include the cause that is so commonly thought of by the layman, namely, lack of exercise, fresh air, and good food. In speaking of this point Dr. Cabot says, "It is important to remember that insufficient food or even starvation does not produce anemia,[3] and so far as we know no form of bad hygiene has any notable effect upon the blood. Persons may grow very pale under bad hygienic conditions, but their blood is usually not affected unless one of the diseased conditions mentioned above is present."

Bad hygiene in connection with diseased conditions aids the development of anemia, and the need of favorable hygiene in overcoming the effect of anemia is well known by many who work with the sick and diseased.

In this connection it is necessary to speak of medicines in the cure of anemia. Hemoglobin contains iron, and for this reason iron has been used for many years in the treat-

[1] Cabot, R. C.: Physical Diagnosis, 5th ed., Wm. Wood & Co., New York, 1912, p. 447.

[2] The explanations in parentheses are mine.—J. F. W.

[3] Selensky, McCollum, and others have shown that food deficient in certain substances has marked effects upon the condition of the blood.

ment of anemia. It is most often prescribed by physicians in a form known as Blaud's pills. These consists of ferrous carbonate and must be prepared fresh. Other methods of administering iron are employed, but the most valuable way to get iron into the blood is through the food eaten. It is a known fact that certain foods are rich in iron, and the most effective way at times to give iron to the body is by securing in the diet foodstuffs that are rich in iron. (See Table VI on page 249.)

In the individual weighing from 132 to 154 pounds there are about 3 Gm. of iron. In numerous experiments to determine the amount of iron needed to sustain the equilibrium of the body Sherman[1] reports that "the requirement appears to have varied with individuals and with the nature of the diet from 0.006 to 0.016 Gm. (6–16 mg.) of iron per man per day." In estimating the amount of food rich in iron required Sherman says, "We might conclude from these results that a daily allowance of 10 to 12 mg. of food should suffice for the maintenance of iron equilibrium in an average man under favorable conditions, but until the conditions which determine a larger metabolism of iron are more clearly defined it would seem desirable to set a higher standard, perhaps 15 mg. of food iron per man per day."

Those who desire to enrich the blood with iron will have more success by eating food[2] rich in iron than by taking iron internally. Taking iron into the stomach and depending upon the processes of absorption and assimilation to change this medicinal iron into blood iron is a doubtful measure.

Appreciating the desire of people to have good blood, unscrupulous manufacturers put on the market and widely advertise preparations which are supposed to have a peculiar power of conveying iron to the blood cells. As illustrative

[1] Sherman, H. C.: Chemistry of Food and Nutrition, The Macmillan Co., New York, 1920, p. 299.

[2] Care must be taken not to be misled by advertisements. Manufacturers and distributors frequently create or capitalize a popular interest in health without assuming responsibility for results. "Have you had your iron, today?" is a familiar slogan. Figure 89 and Table VI will indicate accessible sources of food iron.

of this type of "patent medicine" business the advertisement (Fig. 116) that appeared some years ago in numerous newspapers, is reproduced.

Fig. 116.—Nostrum manufacturers seek to obtain reliability and sanction for their nostrums by securing a physician's endorsement.

Regarding Nuxated Iron, the Journal of the American Medical Association[1] makes the following remarks:

"Nuxated Iron is put on the market by the Dae Health Laboratories of Detroit. On the trade package we read:

> "FORMULA.—The valuable blood, nerve force, and tissue properties of this preparation are due to organic iron in the form of ferrum peptonate in combination with nux vomica, phosphoglycerate de chaux, and other valuable ingredients.

"Packages of the nostrum purchased on the open market were subjected to analysis both in the Chemical Laboratory of the American Medical Association and elsewhere. Qualitative tests indicated the presence of iron, calcium, magnesium carbonate, glycerophosphate, and small amounts of potassium and chloride, and the presence of cascara. Quantitative examinations were made, and so far as the

[1] *Journal American Medical Association*, October 21, 1916, p. 1244.

essential ingredients—nux vomica and iron—of the nostrum are concerned, gave the following results:

"Total nux vomica alkaloids per tablet...... $\frac{1}{500}$ grain.
Iron (Fe) per tablet...................... $\frac{1}{25}$ grain.

"According to these analyses, there is only one-twenty-fifth of a grain of iron in each 'Nuxated Iron' tablet, while the amount of nux vomica, expressed in terms of its potent alkaloids, is practically negligible. If a person wants to take iron on his own responsibility—and this cannot be recommended—it is possible to get this drug in a staple form in the well known Blaud's Pills. In a dollar bottle of 'Nuxated Iron' the purchaser gets, according to our analysis, less than $2\frac{1}{2}$ grains of iron; in 100 Blaud's Pills, which can be purchased at any drug-store for from 50 to 75 cents, there are 48 grains of iron. The claim that 'Nuxated Iron' possesses great advantages over other forms of iron is the sheerest advertising buncombe."

One part of the patent medicine fake is to give the preparation seeming reliability and character by using the name of a physician in the advertising matter. The Journal points out that the physician used to endorse Nuxated Iron is without professional standing.

This preparation has been dealt with at some length because it represents a group of nostrums that advertise to procure health for the individual. This type of business is based upon novelty and constantly new appeals. Although Nuxated Iron is not now advertised so extensively its excessive claims and extravagant advertising are illustrative of the present-day panacea whether that happens to be I-on-a-co or something else. The individual who seeks to live a complete and effective life will leave out of account all such products. Health comes from living in the right way and cannot be secured by taking patent medicine. If one is sick, then health can be obtained only by an accurate diagnosis of the malady and by appropriate treatment to overcome the disease. Moreover, the chances of success in diagnosis and treatment are better with a regular physician in charge of the case.

As regards the use of iron preparations in the treatment of anemia, there is accumulating experimental evidence that the giving of iron is unscientific. The theory of Bunge,[1]

[1] Hatcher, R. A., and Wilbert, M. J.: Pharmacology of Useful Drugs, American Medical Association, Chicago, 1915, p. 362.

that organic iron was more serviceable in anemia, is no longer held by pharmacologists, although urged valiantly by interested manufacturers of organic iron preparations. Recent experimental work at the George Williams Hooper Foundation for Medical Research by Whipple and Robscheit[1] shows that the usual iron preparations prescribed are inert so far as the effect on anemia was concerned, and that dietary treatment was at once helpful and constant in its effects.

On the other hand it would be rash to deny the possible value of iron therapy in anemia even in the absence of convincing scientific experiments; long established practices in giving iron have shown definite clinical results.

Nevertheless, we are coming back in this instance as in so many other cases to look to suitable food, proper care of the body, and correct habits as more useful than drugs in rebuilding devitalized bodies. Potent drugs will always be invaluable help to the physician in the care of sick persons, but hygienic living is the foundation of all sane procedures for both well and sick.

In recent years advances have been made in the treatment of pernicious anemia. Here again the advance has been secured through dietotherapy. The points emphasized are: (1) liver diet, (2) feeding foods of high vitamin content, and (3) assisting this diet by ultraviolet irradiation.[2]

White Blood Cells.—The leukocytes of the blood are concerned primarily in defending the body against a sudden attack of bacteria. They represent the Light Horse Cavalry of the blood, and when infection occurs they respond by a great increase in numbers, and an immediate mobilization at the site of the infection.

[1] Whipple, G. H., and Robscheit, F. S.: Iron and Arsenic as Influencing Blood Regeneration Following Simple Anemia, *Archives Internal Medicine*, May, 1921.

[2] *Journal American Medical Association*, September 3, 1927, p. 793.

Richardson, W.: The Nature of Pernicious Anemia. *Journal American Medical Association*, September 29, 1928, p. 923.

Ordway, T., and Gorham, L. W.: The Treatment of Pernicious Anemia with Liver and Liver Extract (same issue as above, p. 925).

Heath, E. H.: Pernicious Anemia Treated with Liver Diet and Liver Extract (same issue as above, p. 928).

The lymphocytes are concerned in protecting the body in the more chronic diseases, and their number is increased usually in the course of such diseases.

The white cells are strengthened and made better soldiers for the protection of the body by means that increase the general health of the body. There is an increase in leukocytes in the blood after vigorous muscular exertion, cold baths, and massage. These measures tend in proper conditions to increase the general health and by increasing the number of leukocytes they increase the resistance to disease. In disease the count of these cells has important meaning. Experience shows that the higher the percentage of leukocytes, the severer the infection, "while the body's resistance is mirrored in the height of the total leukocyte count." Measures for increasing the number of leukocytes and maintaining a high count are valuable in the maintenance of health. The measures concerned with improving the general health are the rules of hygienic living.

Metchnikoff has pointed out the way in which the leukocytes destroy bacteria by eating them. He called this process "phagocytosis," and gave the name phagocytes ("eating cells") to the leukocytes. In discussing the substances in the plasma the assistance rendered these cells by the opsonins will be described.

It is not known just what part the platelets play in the blood (they are involved in coagulation), and hence no information can be given with reference to them.

Plasma.—The fluid part of the blood is the plasma. It is a straw-colored liquid of exceedingly complex nature. The various components of the plasma and the hygiene related to them follow.

(*a*) *Water.*—Ninety per cent of the plasma is water. It serves to carry in solution the foodstuffs, salts, and waste substances. Its percentage in the blood remains fairly constant. When water is taken into the stomach it is absorbed either partly there or after it has passed into the intestines and colon. Whenever the percentage of water in the blood rises above a certain point it is eliminated from the blood by the kidneys. It may be retained in the tissues

in large amounts in certain diseases when the kidneys and heart are affected, or when the tissues are loaded with salt due to the diminished power of excretion.

Most people probably drink too little water rather than too much. In addition to the water taken in food, it is desirable to drink daily 4 glasses. This should be distributed between meals and on rising in the morning and on retiring at night. The question of hot water and drinking at meal times was discussed in Chapter VII.

(*b*) *Gases.*—The presence of nitrogen in the plasma is of no importance. It is inert and plays no part in the function of the circulation.

The carbon dioxide is a waste product of oxidation. It results from the combustion of food materials. The plasma carries it in solution and it is also found chemically combined with the alkali of the blood in the form of a bicarbonate. The fact that carbon dioxide, an acid, combines with an alkali is significant in that it indicates the way the body acts to keep the blood from developing acidity. Acidity of the blood develops in physical overwork, in certain kidney conditions in which the acid of the blood is not removed by the impaired kidney, and in heart and lung deficiencies in which the excess carbon dioxide is not removed rapidly enough.

A competent heart and blood vessels are most important in maintaining the proper condition of the blood, and an efficient respiratory system is necessary to remove the excess carbon dioxide as fast as it is produced. It is the height of folly to take measures to change the character of the blood when the difficulty lies in the condition of the digestive, circulatory, or respiratory apparatus.

The oxygen is carried in the blood both in the plasma and in chemical combination with hemoglobin in the red blood cells. As stated above, an adequate supply of hemoglobin is essential in transporting oxygen to the cells. There are a certain number of people who are living constantly below the level of their best, because they are unable to carry to their tissues the proper amount of oxygen needed. A series of examinations made on school teachers gives the following

figures on morbidity as presented by Terman.[1] It should be noted that circulatory conditions are prominent in the types of illness presented, and although more prominent for women than men, are factors of importance distinctly related to the other diseases in Terman's tabulation.

THE DISTRIBUTION OF ILLNESS CAUSING ABSENCE

	Male elementary teachers, per cent.	Female elementary teachers, per cent.	Female infant school teachers, per cent.
Nervous troubles	32.3	36.0	31.2
Pulmonary tuberculosis	7.9	6.0	9.3
Other respiratory troubles	17.9	16.8	13.7
Anemia and general debility	5.5	12.0	12.7
Gastric and intestinal troubles	8.9	7.6	8.8
All other illnesses	27.5	21.6	24.3

These figures for teachers are given because they represent the blood and health disturbances in an occupation that is indoors and distinctly sedentary.

The improvement in hemoglobin content of the blood following an outdoor life in camp where good food, adequate rest and sleep, and outdoor air and exercises are provided is frequently remarkable.

(*c*) *Foodstuffs.*—Other important constituents of the plasma of the blood are the three groups of foodstuffs: carbohydrate, fat, and protein. The blood and lymph streams are the only channels by which the food from the digestive tract can be transported to the outlying cells of the body. The character of the blood and its rapidity of movement are vital links in the whole matter of feeding the body. Its nourishing power is dependent upon the carbohydrates, fat, protein, and other substances present.

1. *Carbohydrates.*—Sugar is constantly in the blood in a proportion of 0.1 to 0.15 per cent. This amount is provided by the glycogen supply of the liver, and when during activity the muscles use up the sugar of the blood, the liver

[1] Terman, L. M.: The Teacher's Health, Houghton Mifflin Company, Boston, 1913, p. 16.

at once supplies an amount sufficient to keep up the margin. The supply of glycogen under normal conditions is maintained chiefly by the carbohydrate food. If excessive amounts of sugar are eaten so that the liver cannot effectively store the amount ingested, the oversupply in the blood will be eliminated by the kidneys. There should be a balance between the supply of energy foods and the expenditure of energy. Practically, this means that if one eats large amounts of energy foods, one should engage vigorously in muscular work. Conversely, if one works hard at physical labor, there are required sufficient energy foods to supply that expended. Any other arrangement will result either in loss of weight or increase of weight due to the oxidation of the cells of the body, on the one hand, or the storage of the surplus in the body cells on the other.

2. *Fat.*—Fat is digested in the intestine and broken up into fatty acid and glycerin. These two substances are absorbed, and after passing through the epithelium of the intestinal wall they are synthesized into fat of the form characteristic of the particular animal. It is found in the blood, therefore, as fat, and as such it is transported to the cells. As absorbed it may serve different purposes.

1. It may be at once oxidized and provide energy in the form of heat.
2. It may be stored in the body cells as fat.
3. It may be combined with other substances to form some complex constituent of the body, such as lecithin.
4. It may be changed into sugar and serve the body in that way.

The fat of the body as stated by Howell[1] "originates partly from the fat of the food, particularly in carnivora, and partly from the carbohydrate of the food, especially in herbivora, in whose diet this foodstuff forms such a large part."

There is a good deal of interest in the question of why some people become fat and others on similar diets fail to take on weight. Voit has stated that this difference is due to the varying capacity of individuals to destroy food materials in the body. When food is eaten, digested, and

[1] Howell, W. H.: Textbook of Physiology, W. B. Saunders Co., Philadelphia, 1910, p. 877.

absorbed in excess of the energy requirements of the body, the excess is stored partly as glycogen in the liver, but chiefly as fat. Some people who eat a great deal of food are unable to completely digest or absorb sufficient amount to acquire an excess. Moreover, as Howell[1] states, "A diet which will give such an excess to one individual, may in the body of another of the same weight be all consumed." Differences of this kind are frequently inherited. Individuals who have little tendency to lay up a store of fat may be made to do so by increasing the amount of fat and carbohydrate in the food and by changing the mode of life. Individuals who worry, who expend large amounts of energy in fretting and aimless movements do not store fat easily. Unless the thinness of the individual is marked, there should be no desire to lay up a store of fat. It is so much extra weight to carry and is valuable only as an indication that nutritional processes are active and pronounced. Fat on the body is like money in the bank without interest. It pays no dividends and should not be sought for its own sake. The hygiene of living that makes possible the deposition of fat may be very desirable, but fat itself is of no particular import except for those underweight. The rôle of fat in such cases seems to be that of a reserve food supply.

3. *Protein.*—The protein of the blood exists in three forms—serum albumin, serum globulin, and fibrinogen. The history of protein in the body is uncertain and not as yet clear. Whether or not in the process of digestion the complex protein molecule is split into its final divisions, the amino-acids, and then built up from these units into more complex body proteins, has been a source of some discussion and much investigation. We are not at all certain just what goes on. It has been shown in numerous experiments that proteins have a specific "dynamic action" in the body in that they facilitate the building-up processes of the body to a greater extent than do fats or carbohydrates.[2]

[1] Howell, W. H.: *Loc. cit.*, p. 879.

[2] Burge, W. E.: Reason for Specific Dynamic Action of Protein, *American Journal of Physiology*, March 1, 1919.

For the growing child proteins are more essential than for the adult. The tendency of the day is for people of adult years to eat less meat and obtain the protein necessary from vegetables.

(*d*) *Salts of the Blood.*—In addition to the water, gases, and foodstuffs, the plasma of the blood contains important salts. They serve a variety of functions. The inorganic salts of the blood are valuable in maintaining normal osmotic pressure in the tissues of the body and in some way are combined in the chemical composition of the cells, and are necessary to normal action by the cells. The salts of calcium are important in the coagulation of the blood and the curdling of milk, and the sodium, calcium, and magnesium play a useful part in the contraction of the heart and the irritability of muscular and nervous tissue. The part played by the iron salts in the production of hemoglobin has been described.

1. *Special Considerations.*—It is estimated that the average man takes with his food from 10 to 20 Gm.[1] of salt in the form of sodium chloride a day. This is in excess of the needs of the body because one may keep in good health with only 1 to 2 Gm. in the diet. Bunge has shown that men and animals living on a pure meat diet evince no desire for salt in addition to that in the food, but on a vegetable diet there is an intense craving for salt. This is due to the fact that vegetables are rich in potassium salts which combine with the available sodium chloride, giving potassium chloride and sodium sulfate. One may eat too much salt in the food; there is no danger in eating too little, if the proper selection of foods is made.

There is reason to believe that the abnormal enlargement of the thyroid gland may be due to the absence or presence of certain salts in the diet, because of the geographic distribution of many cases.[2] Goiter may show at puberty, but it usually is temporary. The thyroid also may enlarge

[1] Ten to 20 Gm. = $\frac{1}{3}$ to $\frac{2}{3}$ ounce.

[2] Love, A. G., and Davenport, C. B.: Defects Found in Drafted Men, War Department, 1920, Washington, D. C. Hayhurst, E. R.: The Present Day Sources of Common Salt in Relation to Health, *Journal American Medical Association*, January 7, 1922, p. 18.

at the menstrual period. The pubertal and adolescent enlargements of the thyroid are usually without significance.

The importance of habitat in connection with the development of goiter is given by Osler[1] as follows:

"Goiter, on the whole, is rare in the United States; it is perhaps most common in the region of the Great Lakes. In an investigation in Michigan Dock found a large number of cases, and the disease is not very uncommon in lower Canada. In England it is common in certain regions: the Thames valley, the Dales, Derbyshire, Sussex, and Hampshire. It is very prevalent about Oxford and the upper Thames valley. In Switzerland, in the mountains of Germany and Austria, the mountainous districts of France, and in the Pyrenees the disease is very prevalent. In the regions of Central Asia, in the Abyssinian Mountains, and in the Himalayas there are many foci of the disease."

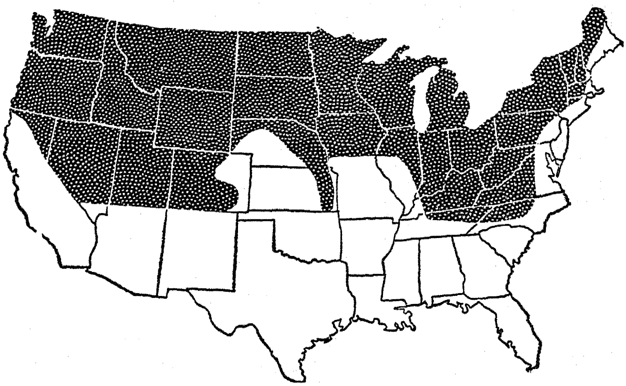

Fig. 117.—The iodine in drinking water in the United States: In the black area, waters contain from 1 to 22 parts of iodine per hundred billion parts of water; in the white area, from 23 to 18,470 parts. Some old analyses have shown even higher values in mineral springs in the southern half of California. (McClendon in Jour. Amer. Med. Assoc.)

At one time goiter was supposed to be due to bacteria or parasites, but today it is known that simple goiter is due to iodine deficiency. Even exophthalmic goiter responds in many cases to the administration of iodine. In the United States goiter is much less common than in Europe, but its geographic distribution in the region of the

[1] Osler, Wm.: The Principles and Practice of Medicine, D. Appleton & Co., New York, 1912, p. 82.

Great Lakes and Northwest coincides with a poverty of iodine in drinking waters of these areas. The maps in Figs. 117, 118, 119, by McClendon, show a close parallelism between low iodine content, simple goiter, and even exoph-

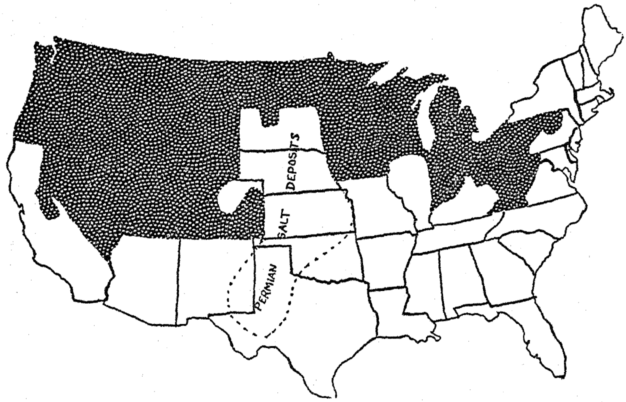

Fig. 118.—Simple goiter in the United States, from data of the Draft Board: In the white area there were from 0 to 5 military goiters per 1000 drafted men; in the black area, from 5 to 111. The military goiter was defined as one too large to button a military collar around. In the region outlined below by the dotted line, and marked "Permian Salt Deposits," an arm of the sea was cut off from the Pacific Ocean by the upheaval of the Rocky Mountains during the geologic age known as the Permian period. Its evaporation left extensive salt beds, which have stratified owing to different solubilities of the salts, as shown by gypsum deposits, rock salt, and deposits high in potash (in western Texas). In very dry regions this material may reach the surface (perhaps secondarily), as shown by the potash lakes of western Texas. In moist regions all the surface salts are washed away and the deposits are reached only in drilling deep wells. The iodine that was in the sea water is mixed up more or less with the other salts; some of it apparently reaches the food and drink of mankind to make this a low goiter region. It should be noted that the black and white areas correspond roughly to those of Fig. 117, the most striking difference being that of New York State. If, however, we had included the waters of Lake Erie and Lake Ontario, which are high in iodine, and excluded the waters from mountain sources, in making Fig. 117, the two areas would have corresponded. (McClendon in Jour. Amer. Med. Assoc.)

thalmic goiter. Zuk[1] describes goiter among the Ruthenians of the Carpathian mountains as due to the cabbage diet of

[1] Zuk, V.: Cabbage and Goiter in Carpathian Ruthenia, *Anthropologie,* Prague, 1931, ix, 1.

the long winter months. He gives no analysis of the iodine content of Ruthenian cabbages. The prevention of goiter is clearly a public health problem, and is dependent in part upon an adequate supply of iodine in food and drink.

On the other hand, it is important to note that for some persons, iodine in food or drink is distinctly harmful. Wholesale medication with iodine either as iodized salt or in water supplies must keep the doses small. Moreover, such water or food is deleterious in specific cases of thyroid disease.

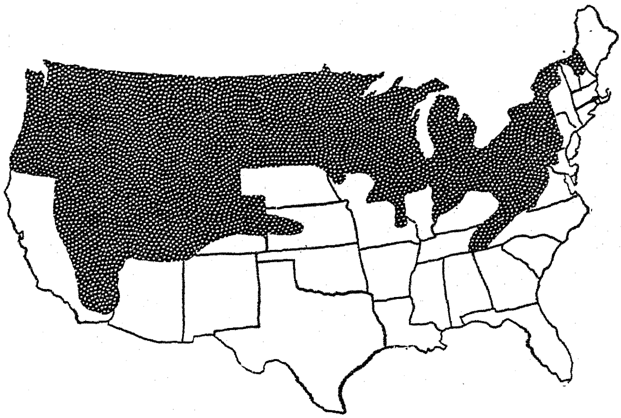

Fig. 119.—Exophthalmic goiter in the United States, compiled from Draft Board statistics. In the white area, from 0 to 2.85 per 1000 drafted men were reported as having exophthalmic goiter; in the black area, from 2.85 to 93. It should be noted that the black and white areas correspond roughly to those of Figs. 117 and 118, except for the edges of contact; but owing to the fact that there is considerable migration of the population, this is to be expected. (McClendon in Jour. Amer. Med. Assoc.)

This is due to the fact that cases of thyroid disturbance other than simple goiter do not respond favorably to iodine. The most scientific use of iodine would be based upon individual diagnosis and prescription, but the general preventive work in a goiter section is so valuable that it should be continued. Hanzlik's[1] experiments show that there is

[1] Hanzlik, P. J., Talbot, E. P., and Gibson, E. E.: Continued Administration of Iodide and Other Salts. *Archives of Internal Medicine*, October, 1928.

not to be expected deleterious effects from prolonged use of iodine in small doses. An exception is to be made, of course, in specific cases of thyroid disease. Methods, however, for selecting out those cases not suitable for iodine medication would be advisable.[1]

2. *Use of Mineral Waters.*—Mineral waters are considered valuable in the treatment of certain diseases, but much of their supposed value lies in the comfortable surroundings, the outdoor activities, the exercise, the baths—all are important factors. Consequently, the use of mineral water away from the health resort is frequently disappointing. Persons in good health do not require special waters; persons with disease should consult a physician.

The use of spring water in cities is not demanded on health grounds unless the city water supply is contaminated.

(*e*) *Protective Substances.*—In addition to the water, gases, foodstuffs, and salts, there are protective substances in the blood, serving to save the body from the ravages of disease. This fact has been known for some time. About forty years ago Traube showed that if a small quantity of putrefying material was added to fresh blood, the blood possessed the power of retaining its normal condition, and this experiment raised the question whether the protective power of the blood resided in the plasma or in the blood cells. Buchner named the germicidal constituents of the plasma "alexins" (defenders).

Metchnikoff was the first to emphasize the importance of the blood cells, and he showed how the white cells of the blood swallowed and destroyed the bacteria. The phagocyte is not always able to win the fight with the bacteria, and if weakened by unhygienic living or disease, or attacked by bacteria either more powerful or more numerous than usual, the phagocytes themselves may be overcome in the contest.

It is also known that there are in the plasma certain substances that make it possible for the phagocytes to more readily attack bacteria. These substances are called "opsonins," meaning "to buy victuals." It is not known

[1] *Journal American Medical Association*, December 19, 1925, p. 1920.

just how they are formed nor what increases their quantity, but it is known that when these substances are abundant, the phagocytes are able to devour large quantities of bacteria; that when these substances are deficient the phagocytes feed less readily upon the bacteria.

There are other protective substances in the blood, probably in the plasma. The story of the scientific experiments that have been laboriously performed to determine these secrets of the blood is too long to be told here. It is a story of great adventure and great achievement.

It is a well-known fact that persons are protected from recurring attacks of a disease once experienced. Most of the communicable diseases, scarlet fever, measles, diphtheria, typhoid, are, as a rule, capable of infecting the same individual only once.

The protection afforded to the individual by an attack of a disease is called "immunity" and is due in part to certain substances developed in the blood in the course of the disease and called by the name "antibodies." By this is meant that these substances have the power of exerting adverse ("anti"—against) action against the invading bacteria. A description of these antibodies and the general character of them is so well given by Evans[1] that he is quoted in detail on this point:

"Many animals secrete poisonous substances which they can, at will, inject into their enemies, and these poisons are called "venoms." Poisonous snakes, scorpions, some spiders, toads, and salamanders may be mentioned as examples. In the venoms formed by these animals there are no germs, but they contain chemical substances, most of which are of extreme virulence. Some snake venoms are so potent that it has been calculated that a quarter of a drop is sufficient to prove fatal to a man within a short time. We may compare such a venom to the toxin produced by bacteria and it will be instructive to consider how an antidote to snake venom can be obtained. It does not appear that the animals that habitually attack snakes, such as the mongoose and the secretary-bird, possess any natural antibodies so that they might be bitten with impunity, for they seem to depend for their safety on their agility. If a series of very small quantity of snake venom (very, very much less than would prove fatal) be injected at intervals into an animal, such as a horse, it will be found after a time, that when a poisonous dose is subsequently

[1] Evans, W.: Medical Science of Today, Seeley, Service & Co., London, 1912, pp. 89, 90.

administered, the animal does not die, and in fact seems none the worse for the dose that would have killed it, if it had not been protected. This immunity is found to be due to certain substances, 'antibodies' as we may term them, in the blood of the animal, and if some of the animal's blood be obtained and the liquid part, or 'serum,' separated from the corpuscles and the clot, 'antivenom' serum, as it is called, is obtained. The action of the antivenom on the venom appears to be purely chemical, the two neutralizing each other, as do an acid and an alkali in a test-tube. If a suitable quantity of antivenom be mixed with a poisonous dose of snake venom and the mixture be injected into an unprotected animal, no harmful result follows. Again, if a suitable amount of antivenom serum be injected into an animal and then later a poisonous dose of venom be injected, no symptoms are caused, for the antivenom already in the body of the animal has neutralized the venom subsequently injected. Nay, more, if a poisonous dose of venom be injected into an animal, and then soon after the correct amount of antivenom be injected—in this case also the animal survives unharmed. But it is absolutely essential that the interval between the injection of the poison and its antidote should not be too long. If the dose of poison is such that would naturally kill the animal in three hours, the antidote must be given not later than one hour after the poison."

This explanation of the nature of antibodies may be added to from a description by Vaughan,[1] who says:

"Immunity due to bactericidal constituents of the blood, whether it be natural or acquired, is always relative. Even the immunity secured by one attack of the disease may be overcome, in most instances at least, by the administration of an overwhelming dose of the virus in virulent form. . . . A highly germicidal blood is of great value in preventing infection, because the first few organisms that find their way into the body are promptly killed before they can multiply and while the amount of poison set free is too small to produce any marked effect."

In another place he says:

"Normal blood and the serum obtained from it contain nonspecific, bactericidal ferments or enzymes. In normal blood these enzymes are not specific and they display marked, distinctive action on certain bacteria, and are wholly without effect with others."

There is, then, normal serum containing general protective agents, and immune serum containing specific defenders against specific diseases. This Vaughan makes clear when he says: "The essential difference between the germicidal constituent of normal serum and that of immune serum is that the latter is specific, while the former is not." Normal

[1] Vaughan, V. C.: Infection and Immunity, Commemoration Volume, American Medical Association, Chicago, 1915, pp. 152, 153.

serum may be made immune by inoculation or vaccination for certain diseases, *e. g.*, typhoid, smallpox.

The process of preparing an antisubstance for certain diseases has developed rapidly in recent years. The different serums used so effectively in the treatment of certain diseases are founded upon this knowledge of the protective nature of normal serum and immune serum. The aim of medical science in the use of immune serums of other animals for treatment of disease in man is to assist the blood by injecting into it antibodies that have been formed usually in the body of another animal.

It is to be remembered that the blood normally contains substances that have the definite power of destroying the poisons of certain bacteria. It would be valuable to know just how far hygienic living serves to increase the formation and powers of these antibodies. The exact significance of this is not known, but it has been abundantly demonstrated that there is very close relation between vigorous health and resistance to infection and disease, and this increased power of resistance probably develops through an increase in strength in the protective substances of the plasma. The vigorous outdoor type of man and woman, active in exercise, healthy in habits, and exact in body care, promise more in high resistance to infection than the indoor, sedentary type with unhygienic habits.[1]

(*f*) *Autacoids*.—These substances, although present in the blood plasma, are so distinctly products of the endocrine

[1] It is not always true that the strong and vigorous endure disease better than the weak. In some diseases the strong man apparently succumbs most readily, due to the fact that his metabolic activity is more rapid and the poison set free by bacteria in the body is broken up to exert its influence more effectively on the strong than on one whose metabolism was slower and less thorough. To support the view that the strong at times more readily succumb to infections than the weak, Vaughan quotes Boghursts' account of the plague in London in 1665:

"Of all the common hackney prostitutes of Luteners-lane, dog-yard, cross-lane, Baldwins-gardens, Hatton-gardens, and other places, the common criers of oranges, oysters, fruits, etc., all the impudent drunken, drubbing bayles and fellows and many others of the *rouge route*, there is but few missing—verifying the testimony of Diemerbroech that the plague left the rotten bodies and took the sound."

glands that they are considered separately in the following chapter.

(*g*) *Waste Substances in Plasma.*—Even as in a fire in the furnace there are ashes of the combustion, so in the body there are substances left by the process of chemical reaction. These waste materials are called "end-products," "waste substances," or "fatigue products." The waste from fats and carbohydrates is chiefly in the form of carbon dioxide and water; that from protein is more complex and consists chiefly of the following: urea, uric acid, and creatine.

The waste as it is formed in the cells of the body is gradually extruded into the lymph spaces of the tissues, and thence finds its way into the circulating blood. The rapidity with which this waste is removed is a good index of the efficiency of the circulation, and a rapid removal is essential for the best and most vigorous health.

There is definite knowledge available regarding the things that tend to increase the amount of waste, and that help in the removal of the excess. It is very important to keep the body as free as possible from substances that are in their very nature poisonous.

Use of food in greater amounts than is required by the body probably results in the same type of reaction in the body as occurs in the furnace when too much fuel is thrown upon the fire. The combustion in each case is partial and incomplete. Any undue amount of waste must be removed in order to secure any really effective combustion at all. Now the waste from fat and sugar is simple and resembles the smoke of a fire; it is readily removed. The waste from protein is complex and resembles the clinkers of the furnace in its more complex character and especially in its difficulty of removal. So that, to reduce unnecessary waste and to secure most complete combustion one will not overeat, and especially one will not eat many nucleoproteins, because they give rise to the purine bases.

To secure efficiency in the handling of food in the body, the processes of digestion, absorption, and assimilation should go on in an orderly, economical, and rapid manner;

such action is impeded by overeating and especially the overeating of meat.

It is important to so live that unnecessary waste is not produced; that the elimination of waste from the cells and tissues will at all times be facilitated and not retarded. Exercise, especially of the out-of-door variety, is absolutely essential in this respect. The contractions of the muscles aid the removal of waste from the tissue spaces, move the lymph along to the heart, and stimulate the complete combustion of food materials.

One so often hears persons speak of the blood as being "bad," and especially in the spring of the year are some inclined to think of the blood as being in a "bad condition." Only recently a student of medicine came to my office to consult me regarding a pronounced case of acne (pimples) occurring chiefly on the back and shoulders. He thought his blood was "bad," and his general feeling of unfitness he attributed to the same cause.

A simple word picture of this youth and his mode of living tells the story. He was accustomed to bathe once a week or in a fortnight, and the condition of his skin, as shown both by the sense of sight and the sense of smell, confirmed his history. His teeth were dirty, and he said that he "brushed them once in a while." He took no exercise at all aside from that involved in walking a half mile to school and home again at night. He was studying disease for the purpose of curing other people, and yet his whole body was a fit subject for clinical study in how not to care for the body. It was perfectly clear that the "badness" in his blood arose from his bad habits of eating, his lack of exercise, and his total lack of the most simple and elemental care of the body. All the pills and medicines in the world, baskets of sulfur burned in his room or in his body, would not bring "goodness" to his blood. The waste products of his body, the clinkers of the furnace, must first be removed before any improvement in his skin could be noted.

The reason why persons so often speak of "bad blood" as accompanying the opening of spring is because one so often

sees people who have lived the most unhygienic lives during the winter—cooping themselves up in a hot and ill-ventilated house, overeating, and generally abstaining from bathing because of the inclemency of the weather. When people learn to eat moderately, to exercise regularly in the open whenever possible, to live in well-ventilated rooms, and to keep the body in all parts scrupulously clean, then, and then only will the question of "bad" blood be removed. Pimples, blotches, cold sores, eczema,[1] and many skin disturbances are often expressions of bad living. God in His wisdom was not visiting our student with punishments, as was once believed; this youth was merely paying the price of living poorly and at a low level.

The "patent medicine" interests would have people believe that "good" blood depends upon medicine. Taking sarsaparilla in the spring will not "purify" the blood. The only reliable procedure for purifying the blood is by removing the waste. This may be done by exercising, especially in the open air, and by lightening the diet. In the diet one should avoid especially pastries, sweets, greasy foods, all alcohol, and much meat, and should partake of fresh fruits, green vegetables, coarse whole cereals, pure milk, eggs, and a little meat.

It should be stated also that acne and boils may represent external infections; these may be related to sugar metabolism, and also to certain hormones in adolescence.

The Vessels.—The vessels of the circulation have been compared to the water mains of a city, but the likeness is in form only. In structure they are very unlike. The arteries are elastic vessels, the veins are collapsible tubes with valves.

The elasticity of the arteries permits them to stretch and respond to the changing demands of pressure in the circulation. This quality provides a very adjustable mechanism especially useful during increased physical activity.

[1] Eczema in infants and children may be a phenomenon of protein sensitization. See The Value of Cutaneous Sensitization Tests Employed in Eczema and Papular Urticaria of Childhood, Sidlick, D. M., and Knowles, F. C., *American Journal Diseases of Children*, April, 1922, p. 316.

The Arteries.—Loss of elasticity in the arteries results in a condition known as arteriosclerosis. This may develop in early adult life or come only in old age. The cause or causes are not known. Donnison[1] in a study of 1000 native Africans in Kenya colony supports the view that arteriosclerosis is a disease associated with civilization. Age alone cannot be regarded as a cause because of the possible factors extending over many years. Moreover, the condition has been found in children.

MacCallum[2] gives an excellent summary of the knowledge of this condition and notes six main points around which fall the experimental and clinical evidence:

1. Hereditary tendencies have been emphasized by numerous workers. Osler[3] has called attention to the fact that one may inherit elastic tissue of poor quality in precisely the same way that one may inherit defective nervous tissue.
2. Hard muscular work has been cited often as a factor. As a condition it is always complicated by the varying standards of personal hygiene. Syphilis and other infections, abuse of alcohol and tobacco, toxins, and metallic poisons in certain trades expose the worker to possible causes.
3. High blood pressure as a cause plays a contradictory rôle. Numerous authors cite "mental activity or overactivity, mental diseases, and various nervous disturbances" as possible factors in arteriosclerosis. Others mention diabetes, chronic nephritis, and obesity as causes.
4. Infections, intoxications, and unbalanced diets are probably the most important causative factors. Ophüls shows in an excellent review that arteriosclerosis is related definitely to infections, especially the chronic infections of the rheumatic type.

[1] Donnison, C. P.: Blood Pressure in African Natives. *Lancet*, January 5, 1929.

[2] MacCallum, W. G.: *Physiological Reviews*, January, 1922, pp. 70–91.

[3] Osler, W.: Modern Medicine, 1915, p. 453.

5. Intoxications of alcohol, tobacco, lead, and intestinal poisons (constipation) have been popularly assigned as causes. The general statements have not been substantiated by workers in this field.
6. Unbalanced diet seems to be a factor, at least in the experiments with lower animals. Experiments with rabbits seem to show that animal food in the diet of the vegetarian rabbit does cause modification in the arterial wall. The relation of this to man, however, is not so clear.

These various causes may be regrouped under two headings: poisons and overwork. The former would include the infections and the intoxications; the latter would include physical, mental and gastric overwork. Extreme physical labor, prolonged for years, continuous overwork in mental tasks, overwork of the gastro-intestinal tract, with or without proper diet, suggest that an important phase of the problem is social adjustment.

One needs to get a true perspective to evade the dangers of modern life. To live the temperate life—temperate in all things, in work, in play, in mental endeavor, in eating and in drinking—is to see straight and keep values clear. Osler advises one to "shun Bacchus and Venus," and the disasters that come from sharing company with those imposters may be avoided.

The Veins.—The arteries are more easily injured, and yet the veins suffer change that interferes with the activity of the individual at times. The veins are concerned with carrying blood from the tissues back to the heart (Fig. 113), and, therefore, should not be obstructed in any way in the performance of that work. Valves in the course of the veins prevent the backward flow that would otherwise result in a system under such low pressure and in part working against gravity. Muscular activity is very important in assisting the onward flow of blood in the veins.

One needs to be guided by two principles in preserving the normal conditions of the veins—exercise that will give assistance to the return of blood to the heart, and freedom of the venous return flow by not wearing tight bands, tight

garters, tight collars, or tight corsets. The body should be as unhampered by clothing as it can be.

Varicose Veins.—Varicose veins are broken-down vessels in which the valves and walls have given away resulting in slowing of the circulation in the part involved. Varicosities result from a variety of causes.[1] Prominent in their production is obstruction at some point between the varicosity and the heart. This may be due to a thrombosis (inflammation of the wall of the vein with clot formation), pressure on the vein from without, as in tumor growth or pregnancy, or to structural change in the liver preventing an unimpeded return of blood to the heart. Aside from obstruction it is known that occupation influences the condition. Prolonged standing with its accompanying congestion in the legs accounts for certain cases. It is commonly known that motormen suffer from varicose veins, while postmen are peculiarly free from the condition. Athletes engaging in pole vaulting and high jumping at times develop varicosities, due apparently to the effect of landing on the feet violently. The influence of obstructing bands, such as garters, corsets, and belts, is probably also important in many cases.

Mild cases of varicose veins require no special treatment. Surgery is often required when supportive treatment by elastic stockings is not effective.

The Heart.—The blood, vessels, and pump were noted as the chief elements in the circulation. The constituents of the blood may be normal, the vessels elastic and efficient, and yet, if the pump is unable effectively to do the work of pushing the blood to the tissues and forcing back the venous blood, the efficiency of the scheme is gone.

The heart (Fig. 104) is made up of muscle and divided into four chambers that are connected with each other through valves and vessels. Now, as a pump, it is dependent upon two factors: the valves must fit tightly and work properly, and the muscle of the heart wall must be strong

[1] The significance of gravity is shown in the greater frequency of varicose veins among tall persons. See Statistics, vol. xv, Part I, Army Anthropology, The Medical Department of the United States Army in the World War, Washington, D. C., 1921, pp. 345, 346.

and controlled enough to produce a vigorous heart impulse. Injury to the valves of the heart or to the heart muscle itself not infrequently occurs. The valves are delicate little leaves that are easily injured by certain forces; the heart muscle is supplied with blood exactly as are the other muscles of the body and has endurance or lacks it precisely as other muscles do. It is just as dependent upon good food as the other parts of the body, and its importance is fundamental because of the dependency of other organs upon the circulation. Alcohol, tobacco, or poisons from disease in the body may ruin a heart just as bad oil will ruin an engine. In many ways it is helpful to think of the heart as a little motor pumping about 10 tons of blood a day—a tidy job for a 10-ounce motor.

Injury to the Valves.—The valves are most frequently injured by infectious disease. The bacteria that may gain access to the blood at the time scar and destroy the shape of the valves, and prevent them from effectively controlling the blood in the proper chambers of the heart. The following communicable diseases are most important in this respect and, therefore, should be avoided as far as possible: acute rheumatic fever (rheumatism), scarlet fever, tonsillitis, syphilis, and pneumonia. Infected teeth are also important as a cause of injury to the heart because they serve frequently as the gateway through which the organism that causes rheumatism enters the body.

Table XI, presented by Halsey[1] from a study of New York school children, shows the prevalence of certain diseases in cardiac cases as compared with noncardiacs.

It is with regret that one finds parents so often without appreciation of the danger to the child of having the so-called "children's diseases." It should be emphatically stated that these diseases do *not* belong to children at all and should never be contracted unless absolutely unavoidable. A child of eight years recently seen in the hospital gave a history of having had scarlet fever, pneumonia, neuritis, measles, whooping cough, chickenpox, mumps, tonsillitis. Her heart

[1] Halsey, R. H.: Heart Disease in Children of School Age, *Journal American Medical Association*, August 27, 1921, p. 672.

TABLE XI

COMPARISON OF HISTORY OF OCCURRENCE OF INFECTIOUS DISEASE OF CARDIACS AND NONCARDIACS

	Cardiacs.		Non-cardiacs.	
	Number.	Per cent.	Number.	Per cent.
Tonsillitis	82	64	55	18
Rheumatism	57	45	16	5
Measles	45	36	176	58
Pneumonia	23	18	14	5
Diphtheria	21	17	27	9
Chorea	18	14	1	
Pertussis	17	13	100	33
Scarlet fever	16	12	14	5
Influenza	2	..	17	5
Bronchitis	8	..	0	
Typhoid	2	..	0	
Nephritis	2	..	0	
Jaundice	1	..	0	
Otitis media	1	..	0	
Chickenpox	0	..	12	4
Polyomyelitis	0	..	4	1
Total	125		297	

was badly damaged. This was to be expected as a result of the infections she had experienced.

Injury to the Muscles.—For years many have felt that athletics injure the heart because of the intense strain on the circulation in athletic contests. Numerous studies and clinical experiences have changed this point of view. Lee in examining thousands of Harvard students found that athletics did no harm to students with normal hearts. The Kahns[1] assert that the heart and circulation can stand strain if the person has been trained to gradually increasing labor or athletic work. Even in the trained person the heart must have adequate rest before the next effort is made. They note, however, that heart strain may occur with exertion that follows an acute illness, after fatigue, or during an anemia and also that athletes who have followed sedentary

[1] Kahn, N. H., and Kahn, S.: *Annals of Internal Medicine*, April, 1928.

occupations for some time and who then engage in vigorous exertion such as mountain climbing may suffer heart strain.

Farrell[1] and his associates studied the effects of exercise on heart size. They report that the immediate effects of long distance running are inconsequential since all the changes may be found in persons of similar age without symptoms. This agrees with the studies by Karl Eimer and Herxheimer. The latter reports that the size of the heart in persons taking part in several sports and in short distance runners differs only slightly from average individuals. Marathon runners, however, have large hearts. These conclusions are based upon the examination of 246 Olympic athletes at Amsterdam in 1928.

Opinions then, about the effects of athletics on the heart, are rapidly changing, and most workers in this field are saying that the heart is not injured in the performances of athletic events unless there exists at the time of the participation an infection. Mackenzie, of England, than whom there is no greater authority on the heart, takes this position. If the tonsils or teeth are infected, or if a focus of infection is present anywhere in the body, vigorous exercise is not desirable. One who has a normal heart may engage freely in exercise if the body is free from infection.

The influence of preexisting disease, metallic poisons, and emotional excitement are mentioned by Phipps[2] as important for those engaged in physical occupations. Emotional excitement will not injure the muscle, but the first two will. Phipps says: "Trauma and muscular strain damage the tonicity or contractility, or produce an acute dilatation, when there is pre-existing disease; metallic or bacterial poisons may cause or aggravate lesions of the muscle, valves, or innervation; emotional stress may upset the normal rhythm."

The Convalescent Heart.—After a prolonged sickness or an operation the heart is weakened because of two factors: the poisons from the disease and the inactivity of the body.

[1] Farrell, J. T., Jr., *et al.*: Effects of Exercise on Size of Heart, *American Journal Medical Sciences*, March, 1929.

[2] Phipps, C.: Heart Disease in Industry, *Journal American Medical Association*, February 25, 1922, p. 562.

During and following an attack of rheumatism or tonsillitis the heart is very liable to injury. Complete rest in bed during the disease and very gradual activity afterward are important. No one can afford needlessly to endanger the heart; it is too vital an organ. Remembering that the heart is a muscle, it will be easy to comprehend how inactivity weakens the heart by comparing the effects of nonuse of the skeletal muscles. Therefore, after a period of illness in bed, the individual should begin, gradually, an active life. A sudden exertion before the heart has been strengthened by exercise may result disastrously.

The Influence of Poisons upon the Heart.—The practice by the laity of using certain drugs for colds and headaches is distinctly dangerous because of the injury to the heart. Most headache remedies depend for their effectiveness upon acetanilid. Acetanilid, antipyrine, and phenacetin are drugs made from coal tar. They have a definite depressing effect upon the heart muscle. They should not be used indiscriminately. They are dangerous, and yet there are on the market hundreds of so-called "headache and cold cures," labeled "absolutely safe," that depend for their effect on acetanilid. Aspirin, widely advertised as a remedy for colds, headaches, and pain in general, is not without danger to the heart. Self-diagnosis and self-treatment of disease are unscientific and should not be undertaken by one who aims to achieve for himself the best in the way of living. Simple disorders requiring home remedies and home care may, of course, be handled without medical aid. Disorders, however, that require drugs should have scientific and intelligent diagnosis and therapy. Only a reputable physician can give this.

The Influence of Tobacco.—Tobacco presents to the lay mind a moral question. It is usually discussed on that basis by the opponents of its use. It is more rational to discuss it as a health question. Its effect on health and particularly its effect on the heart has been a matter of fact for some time.

Investigations carried out on healthy men and on men suffering from "soldier's heart" by Parkinson and Koefod[1]

[1] *The Lancet*, August 18, 1917, cxciii, No. 4903, p. 232.

showed the following immediate effects of cigarette smoking on such individuals:

"1. The immediate effect of cigarette smoking upon the circulatory system and upon the breathlessness of exertion was observed in 30 smokers, of whom 20 were men affected with 'soldier's heart' and 10 were healthy soldiers. Each subject smoked either four or five cigarettes during a period of forty minutes.

"2. A demonstrable effect was recorded in 17 of the 20 patients; the 3 unaffected were noninhalers. Nine of the 10 controls, all inhalers, were influenced in the same fashion, though not to the same degree.

"3. The average pulse-rate among the patients during smoking was nine beats higher than before smoking; in the health controls it was six higher. Initial slowing of the heart was never observed, nor any irregularity referable to smoking.

"4. The rate of respiration in the patients was unaffected; in the controls it was slightly reduced.

"5. The average systolic blood-pressure was raised by 5 to 10 mm. Hg, and the diastolic by 5 mm., both in patients and controls.

"6. These effects appeared within five minutes; with the first cigarette they almost reached the maximum, and this was maintained throughout the smoking period.

"7. A simple exertion test was performed before smoking and repeated on its cessation. In the patients the pulse-rate maintained a higher level throughout the test *after* smoking, and half of them were more breathless both subjectively and objectively. In 2 patients precordial pain was induced by smoking, apart from exertion. But in the controls the pulse-rate curve during exertion was much the same after smoking as before, and breathlessness was induced in two only.

"8. These observations show that, in health, the smoking of a single cigarette by an habitual smoker usually raises the pulse-rate and blood-pressure perceptibly; and these effects are a little more pronounced in

cases of 'soldier's heart.' Moreover, the smoking of a few cigarettes can render healthy men more breathless on exertion, and manifestly does so in a large proportion of these patients.

"9. Excessive cigarette smoking is not the essential cause in most cases of 'soldier's heart'; but, in our opinion, it is an important contributory factor in the breathlessness and precordial pain of many of them."

While these circulatory changes can be demonstrated, it is important to remember that they may not be as serious in their effect as would seem to be implied. Certainly smoking to excess is injurious to health. For some, one cigar may be "excess"; for others the margin is greater. For any person "four or five cigarettes during a period of forty minutes" is marked excess.

Tobacco may have a pronounced effect upon the vascular system. Sulzberger[1] shows that allergic reactions to tobacco are readily observed. Patients suffering from thrombo-angiitis obliterans (a disease of the blood vessels) showed 92 per cent sensitive to a patch test. White and Sharber[2] report neither the use of, nor the abstinence from, tobacco or alcohol plays an important part in the origin of angina pectoris. In occasional cases tobacco aggravates attacks, and in a few cases alcohol relieves or prevents attacks.

The Nicotine Content of Tobacco.—Analyses of the nicotine content in various tobaccos as determined by the Connecticut Agricultural Experiment Station and as published by the Journal of the American Medical Association[3] showed that the nicotine content in some tobaccos is more than 100 greater than in others. But as shown by Dixon[4] in his investigation of the subject there are other constituents than nicotine to consider when viewing tobacco from a health angle. These considerations may be summarized as follows:

Nicotine, which is usually looked upon as the *bête noire*

[1] Sulzberger, M. B.: *Journal Immunology,* January, March, May, 1932; abstr. Bulletin New York Academy Medicine, May, 1933.

[2] White, P. D., and Sharber, T.: Tobacco, Alcohol, and Angina Pectoris, *Journal American Medical Association,* March, 1934.

[3] *Journal American Medical Association,* July 29, 1933, p. 385.

[4] Dixon, W. E.: *British Medical Journal,* October 22, 1927.

of the smoker, is by no means the only constituent of tobacco that is harmful, although it is probably the most important; but there are, for instance, ammonia gas, pyridine or pyridine derivatives, and carbon monoxide.

Moreover, the amount of nicotine in tobacco is not necessarily any criterion of the amount of nicotine the smoker will get. When tobacco is smoked, part of the nicotine is burnt and a part passes in smoke as free nicotine. The drier the tobacco, the greater the destruction of the nicotine. Dixon is strongly of the opinion that moist tobacco produces much more serious effects than dry tobacco, the water content of the tobacco, in his opinion, being more harmful to the smoker than the original nicotine.

The amount of nicotine and other volatile substances that reaches the smoker also depends on the form in which the tobacco is smoked. A cigarette or slender cigar which is well cooled will yield less nicotine and other volatile substances than a thick cigar. Virginia tobacco leaf, from which cigarettes are made, often contains twice the amount of nicotine that is present in a Manila cigar, yet when equal weights of cigarettes and cigars are smoked, the total cigar smoke contains double the amount of nicotine present in the cigarette smoke. In pipe smoking the amount of volatile products, including nicotine, that reaches the smoker depends to no small extent on the construction of the pipe. In the long clay pipes of the old "church-warden" type, there is great opportunity for the nicotine to condense, so that the smoke, when it reaches the smoker, may be almost free from that substance.

A Need for Accuracy.—The leaf of the tobacco plant is used for smoking and chewing, and in powdered form as snuff. There are many reasons why tobacco should not be used by man, and probably few reasons for its use. With this viewpoint there are some people who say that a person who uses tobacco is a fool, and that he will go insane if he smokes cigarettes. Now such a statement is at variance with the facts. In condemning or praising any method or practice care should be exercised in forming a judgment and discretion used in stating a belief. What does tobacco do to the cells of the

body?[1] How does it injure them? What may be the loss in terms of efficiency? These are the questions that we should be prepared to answer.

General Effects of Tobacco.—In the first place we know men who are strong physically, keen mentally, and sound morally, who at times use tobacco. If they use it moderately, they may reply to our question by saying "smoking does not hurt me." By such a statement one means that there is no perceptible harm. Some experiments[2] indicate that moderate and habitual use of tobacco is not harmful to *adults* and distinctly helpful to certain ones.

It is true that the use of tobacco forms a habit that tends to increase the amount of tobacco used. This is the special danger in cigarette smoking. It leads frequently to the use of so many cigarettes that health and strength are lost.

That smoking causes undesirable effect upon the body is shown in the custom of college athletes. Coaches and trainers do not permit smoking by those who play on the team, and all athletes who seek to excel in sport do not use tobacco.

We know that smoking impairs one's physical efficiency. A war correspondent, visiting the Italian trenches in the Trentino during the recent war, writes as follows:

"As we pushed on, all our old sins of pipes and cigarettes began to be expiated in our middle-aged hearts. . . . So we struggled on, the easy perspiration bathing our bodies. Hiatt was doing better than I, being younger and less guilty of cigarettes. I could force myself until I could go no further; would stop; would droop over my alpenstock and pant like a netted fish."

Men who smoke to excess find that they become nervous, lose their appetite for wholesome food, and show a distinct loss in efficiency. On the other hand, many men who smoke moderately testify to the values they experience in

[1] Webb, G. B.: The Effect of the Inhalation of Cigarette Smoke on the Lungs, *American Review of Tuberculosis*, 1918, vol. ii, p. 25; Krause, A. K.: Tobacco Smoke and Pulmonary Tuberculosis, *American Review of Tuberculosis*, 1918, vol. ii, p. 99.

[2] Gies, W. J., and others: Effect of Tobacco on Man, *New York Medical Journal*, June 1, 1921, p. 809.

satisfying a habit that for them has no known deleterious effects.

The Effects of Tobacco upon Youth.—The youth who looks forward to physical efficiency as well as mental efficiency as important factors in doing a work and achieving a place in the world, should leave tobacco alone. The growing boy is injured by the use of tobacco. His growth is interfered with, his heart is made irritable, and his stomach disturbed. If the boy thinks he wants to smoke, he should wait until he is twenty-five years old; then with developed body and a wiser mind, if the use of tobacco seems desirable, let him make the choice, cognizant of its dangers and limitations. The youth who looks forward to excellence in athletics, to achievement in business or the professions, to authority and control in store and factory, will select his habits as carefully as his friends, his food as carefully as his facts, and he will leave tobacco out of the things that are for him.

Tobacco and the Sexes.—The increase in the use of tobacco by woman has caused great concern to many people who are interested in racial health.[1] The statement has been made that smoking is more serious in its effects on women because of their possessing a more delicately adjusted nervous system. Claims are also made that women who smoke will bear children with tobacco heart. No proof of a scientific kind has been presented to show this. Professor Schrumpf-Pierron[2] reviewed the medical literature for the Committee to Study the Tobacco Problem. The summary of his research is accompanied by 70 pages of bibliography. There is no mention of tobacco heart in newborn children. Smoking by women has no apparent influence over the reproductive system.

It is contended by some that women smoke excessively more frequently than men. There are no data to prove this. It is apt to be true that one will smoke more during leisure

[1] Williams, J. F.: Smoking by Women, *American Journal of Nursing*, June, 1927.

[2] Pierre Schrumpf-Pierron: Tobacco and Physical Efficiency: A Digest of Clinical Data, Paul B. Hoeber, Inc., New York, 1927.

than during work hours, and since women may have more leisure than men, they face the hazard of excess in smoking that may be associated with leisure.

QUESTIONS AND EXERCISES

1. List the functions of the circulation.
2. Compare causes of death from heart disease with tuberculosis; with cancer; with pneumonia.
3. State causes for increase in chronic diseases.
4. List factors which cause heart disease in middle life.
5. List parts of the circulatory system.
6. Describe the red blood cells.
7. What is hemoglobin? What foods produce hemoglobin?
8. State the causes of anemia. Give steps to avoid or correct anemia.
9. Describe the white blood cells. State the function of the leukocytes and lymphocytes.
10. List the contents of the plasma.
11. List the protective substances of the blood.
12. Define immunity. What are antibodies? How may immunity be conferred artificially?
13. What are common notions regarding "bad" blood? When might blood be bad from a scientific point of view?
14. Describe the condition known as arteriosclerosis. State causes of this condition.
15. What are varicose veins? State causes.
16. Describe the heart. State fully the influence of athletics upon the heart.
17. How may the heart valves be injured?
18. Describe the influence of poisons upon the heart.
19. How does tobacco affect the heart?
20. State the effects of tobacco upon youth. Distinguish as regards these effects upon the sexes.

CHAPTER X

HYGIENE OF THE ENDOCRINE SYSTEM

Anatomical and Physiological Backgrounds.—The glands that give secretions into the blood stream might properly be discussed in connection with the circulation, although their effects are general in character. Recent studies have increased knowledge about them and it is customary to refer to them as the endocrine system. They will be described individually (Fig. 120).

The Pineal Gland.—The pineal gland, located in the brain, attained considerable importance as early as the seventeenth century when Descartes designated it as the seat of the soul. Modern examination has never substantiated this early speculation. It appears to be a vestigial organ, a remnant of a third eye; it probably gives an internal secretion, but this function is not known.

The Pituitary Gland.—This gland, a projection on the under surface of the brain, has been thoroughly studied and its functions, well described. It has three parts. From the front part comes a secretion that stimulates growth in size, sex development, and the secretion of milk in lactation. From the middle part comes a secretion that effects the production of urine. From the rear portion flows a secretion that causes the contraction of smooth muscle. It will be

noted that giantism and dwarfism are expressions of the activity of the first portion of the pituitary, and that the tone of smooth muscle is affected by that from the last part.

The relationship between the pituitary and the gonads (ovary and testis) is now definitely established. The anterior

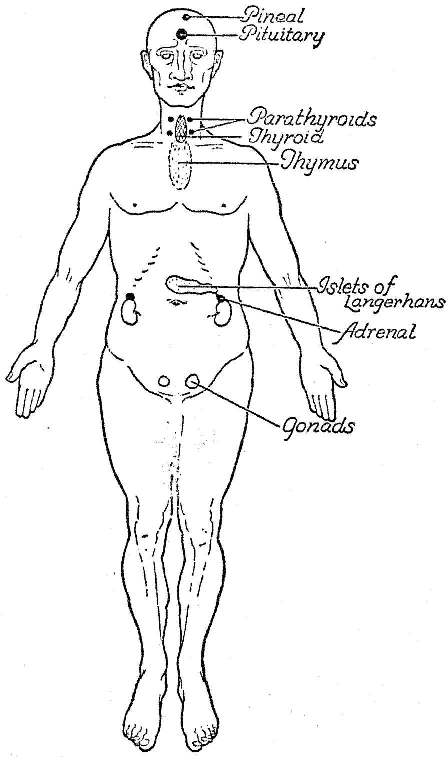

Fig. 120.—Distribution of the glands of internal secretion.

lobe produces a secretion that initiates and maintains gonadal function. Constitutional types of build and the appearance of secondary sex characters are manifestation of pituitary activity. While experimental data have been extremely interesting, it is notable that there is little known

as yet regarding the normalizing of these functions by hygiene.

The Thyroid Gland.—The thyroid gland lies in the neck in front of the trachea, just below Adams' Apple. It has two lateral lobes that connect in front by a smaller portion, the isthmus. The secretion produced by the gland has profound effects upon growth and development. When the secretion is increased the individual is more energetic, expends energy profligately, and manifests excessive nervous activity. When decreased in amount, the individual shows lethargy. In infants, lack of adequate secretion produces cretinism. Goiter is an enlargement of the thyroid. This may be associated with increased, decreased, or no altered secretion. The active principle of the gland is called thyroxin.

The Parathyroid Glands.—These are several small bodies that lie behind and beneath the lateral lobes of the thyroid. The secretion of these influences the metabolism of calcium. Removal of the parathyroids causes death.

The Thymus Gland.—For some time the thymus has been regarded as a gland of internal secretion but recent experimental evidence is quite contradictory and it is a question whether or not it provides a secretion.

The Adrenal Glands.—These have been thoroughly studied. These are two glands, lying on the upper ends of the kidneys. They yield two substances to the blood, epinephrine and cortin. The former helps to maintain blood pressure and muscle tone. It is produced lavishly during emotional excitement characterized by anger, joy, or rage. The substance, cortin, has an unknown function.

The Pancreas.—It was learned that the pancreas gives a digestive juice, but groups of cells in the pancreas, called the islands of Langerhans, yield a substance to the blood. This material is required in the utilization of sugar by the muscles. When deficient, sugar cannot be burned, it accumulates in the blood and the excess is removed by the kidneys. The disease is called diabetes. Before the discovery of insulin, the artificially prepared secretion of the pancreas, the disease was often fatal.

The Ovaries.—The ovary produces two endocrines. One, called estrin, influences the onset of menstruation. It is produced in relation to the escape of the ovum from the ovary. The second one, called progestin or corporin, has been demonstrated in animals but its function in the human is still unknown. In animals it inhibits the menstrual process and aids in pregnancy.

The Testes.—In addition to the spermatozoa produced by these glands, there is an internal secretion that influences the development of certain male characteristics such as facial hair, and deep voice.

Brünner's Glands.—It has been previously noted that certain glands of the first portion of the intestine produce a secretion, called secretin, that stimulated the flow of bile, intestinal juice, and pancreatic juice. These glands are called Brünner's glands.

The Nature of the Endocrine Glands.—It has been stated that the endocrine glands produce secretions that pass into the blood stream and hence affect structures and functions far removed from the site of the glands. It is known that some of these glands are highly active under emotional excitement and that control of their secretions is through emotional control.

"The active principles of these secretions have been called *autacoids,* meaning self-remedy. Autacoids that stimulate are called *hormones,* those that inhibit, *chalones.*"

From the earliest times there has been a practice to assign certain virtues to certain organs of the body and especially in the treatment of disease of the same organs. Thus it is that the works of Celsus and Dioscorides advocate the giving of organs from animals for the treatment of disease of the same organs in man. Savage man in the belief that bravery was a matter of the heart cultivated the custom of eating the hearts of his enemies which he had slain in order to increase his own courage. Throughout the eighteenth century the lung of the fox was advised for shortness of breath, for the fox is able to run long distances at a high speed; the brain of the hare for tremors, and rennet for disorders of the stomach.

Very little has ever been determined[1] concerning the ways in which man can utilize the internal secretions so as to enable him to live more effectively, but there are a few indications that emphasize the avoidance of certain acts in order to preserve his health with reference to the way in which these glands operate.

The thyroid regulates the metabolism, or rate at which life functions go on. If its secretion is decreased in children, cretinism results or in adults mental and physical sluggishness occurs. Overactivity of the gland results in high blood pressure, loss of weight, and nervous excitability.

The thyroid may undergo enlargement especially during adolescence. This simple type of goiter, more prevalent in girls than in boys and distributed in certain states, may readily be prevented by the addition of iodine to the drinking water or by the use of iodized table salt. In Michigan such salt may be secured at grocery and supply stores. Lack of development of the thyroid in children may be compensated very largely by internal administration of thyroid extract, a preparation made usually from the gland of a sheep.

The parathyroids have some influence on the metabolism of calcium and phosphorus.

The thymus functions until maturity and is regarded as giving an important secretion that influences the development of the secondary sex characters.

The pituitary located in the brain gives three secretions. One from the middle part has an unknown function except in diabetes insipidus. One, *pituitrin*, from the posterior lobe stimulates smooth muscle. It has important uses in medicine. One from the anterior lobe relates to growth in size and stimulation of the ovaries and testes.

The adrenals produce a secretion from the medullary portion, *epinephrine*, known commercially as *adrenalin*, and one from the cortex that may have a variety of functions.

[1] The use of animal extracts of the glands of internal secretions has grown rapidly of late. Endocrinology has not progressed far enough for the impartial observer to advise with any assurance concerning general matters or general principles.

In the pancreas are groups of cells known as islands of Langerhans that yield a secretion, called *insulin*, an indispensable substance in the metabolism of sugar.

The secretions from the ovaries and testicles are so important that they make the characters that mark the female, on the one hand, and the male on the other; they are essential to the development of the most vigorous type of manhood and womanhood. It is most important for woman to avoid gonorrhea because this disease frequently invades the ovaries, requiring removal of the diseased organs. Serious disturbance of health often follows the artificial menopause produced.

In recent years there has been considerable interest in the rejuvenation experiments of Steinach and others. Recently Nacht and Teagarten reported upon the ligation of the vas in six rats. Some of the rats showed improvement in general appearance and behavior, were more active, and several developed a new coat of fur. These changes, however, were temporary and all the animals shortly relapsed into the usual senile state.

While there is no final word on this topic at the present time, the evidence from numerous sources seems to show that in man the rejuvenation effects, even when favorable, are partly psychologic and, at all events, are of temporary value only. Indeed, since other endocrine organs are very important in sex efficiency, further study may bring out the exact rôle played by the thyroid, pituitary, and adrenal in the state of senility.[1]

The Endocrines as Chemical Coordinators.—There are various suggestions from the evidence of endocrine function that these glands are not only coordinated with respect to themselves, but also are coordinators of growth, development, and numerous functions. The precise relationships are not known, but such a simple thing, apparently, as bone growth cannot proceed properly, even if calcium is abundant, without the parathyroid secretion to coordinate the process.

[1] Belfield, W. T.: Some Phases of Rejuvenation, *Journal American Medical Association*, April 19, 1924.

The Endocrines and Obesity.—Overweight is often a disproportion between the *intake* of food and the *output* of work which would, in a balanced state of living, burn up the intake. Frequently, however, obesity is a manifestation of endocrine disturbance. Two glands are involved, the thyroid and the pituitary. Obesity of the glandular type is due to decreased secretion of the thyroid or pituitary, usually the former. This condition should have the careful supervision of a physician.

Patent Medicines and Weight.—The desire of obese women to reduce is exploited by the patent medicine industry. Numerous "antifat" remedies are on the market. Some contain thyroid extract which will increase metabolism and reduce weight. Use of such preparations is highly dangerous, because they may disturb other secretions and cause more endocrine disturbance than they correct.

Control of Weight.—Overweight or underweight may be a manifestation of endocrine function, but in all cases care and attention to intake and output are important. If the weight is increasing beyond desirable limits, which should be determined by consideration of hereditary type of build, and age, then reduction of intake in food plus increased exercise will help. In reduction it is important not to omit essential vitamins and salts from the diet. If the weight is decreasing beyond desirable limits, this may be a sign of beginning disease, such as tuberculosis. If disease is not present, increase in intake of food plus rest and less exercise will help. It is exceedingly difficult, if not impossible, to make helpful general statements covering all cases—there are so many exceptions and special considerations. For this reason, it is best to consult a physician when weight changes are desired.

General Hygienic Principles.—It should be remembered that the endocrine glands are cellular structures, subject to the same effects of disease or poisoning that accrue to other highly specialized structures. Tuberculosis of the adrenals produces Addison's disease, and its prevention is the prevention of tuberculosis. Gonorrheal infection of the ovaries points to the prevention of gonorrhea. Any infection that begins in the organism may begin or extend to an endocrine

gland and hence prevention of infection is important. Poisons that enter the circulation may affect endocrine glands.

Too much load may be placed upon a gland. Persons consuming large amounts of sugar throw heavy work upon the islands of the pancreas. Individuals of the "nervous" type exhibit hyperfunctioning of the thyroid, but these persons may learn to rest the thyroid by avoiding excitement, late hours, and "overdoing." There is a causal factor here but the resultant is controlled in part by controlling the cause.

QUESTIONS AND EXERCISES

1. Name and locate the endocrine glands.
2. What are the three parts of the pituitary?
3. What is cretinism? How is it caused?
4. What is the source of epinephrine?
5. Where are the islands of Langerhans?
6. How effective is surgical rejuvenation?
7. Define obesity. What are the types?
8. Describe the injuries that may occur in infection involving the endocrine glands.

CHAPTER XI

HYGIENE OF THE EXCRETORY SYSTEM

I. Anatomical and Physiological Backgrounds.
II. The Skin as an Index of Health.
III. Care of the Skin:
  1. The Warm Bath.
  2. The Hot Bath.
  3. The Cold Bath.
  4. Substitutes for the Cold Shower or Tub.
  5. Foot Infections from the Bath.
  6. The Habit of Bathing.
  7. Other Forms of Bathing:
    Sea Bathing.
    The Turkish Bath.
    The Russian Bath.
    The Sun Bath.
IV. The Complexion.
V. Care of the Hair.
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VII. Care of the Hands.
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IX. The Clothing of the Body:
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X. Elimination of Body Waste by the Kidneys.
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XV. Intestines as Organs of Elimination.
XVI. Causes of Constipation.

Anatomical and Physiological Backgrounds.—Waste material of chemical activity is eliminated from the cells by several channels. Carbon dioxide, a waste substance, is removed by the lungs. The residual waste of digestion in the alimentary canal is removed periodically in bowel movements. The complex chemical compounds that result from cellular activity are first taken up by the blood and lymph and then sent to the kidneys which are the main excretory

organs. The skin aids slightly in this process and its minor rôle should be mentioned.

Nature and Function of the Skin.—The skin (Fig. 121) is composed of innumerable layers of flat cells that rest upon layers of cuboidal cells. The cells of the outermost layer are dead; the ones of the innermost layer are alive. Between these two, varying degrees of vitality exist. From the innermost layer new cells are produced. The skin is continually renewed from within outward.

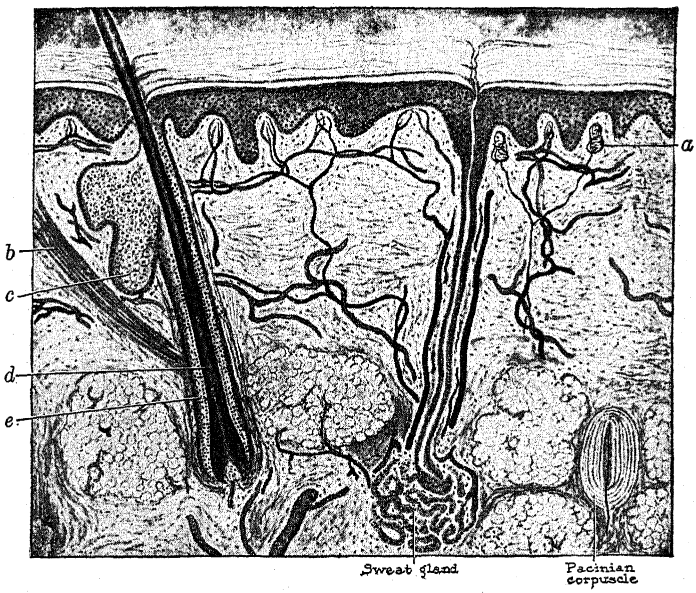

Fig. 121.—Diagrammatic illustration of the anatomy of the skin and its appendages. *a*, Meissner's corpuscle; *b*, M. arrector pili; *c*, sebaceous gland; *d*, hair; *e*, hair follicle. (From Andrews, "Diseases of the Skin.")

This structure of the skin shows something of its function. It is suited for protection. Only with difficulty can substances penetrate the outer flat-cell layer to reach vessels below. Hence, the skin is a protective rather than an absorbing organ. Its minor rôle in elimination is played by

a number of glands located deep in the skin with ducts that open on the surface. These are coiled structures, called "sweat glands." They give off in a day from 1 to 2 pints of liquid. This excretion when profuse is composed of small quantities of sodium chloride, sulfates, phosphates of the alkaline salts, urea, uric acid, creatinine, aromatic oxy-acids, ethereal sulfates of phenol and skatol, and at times

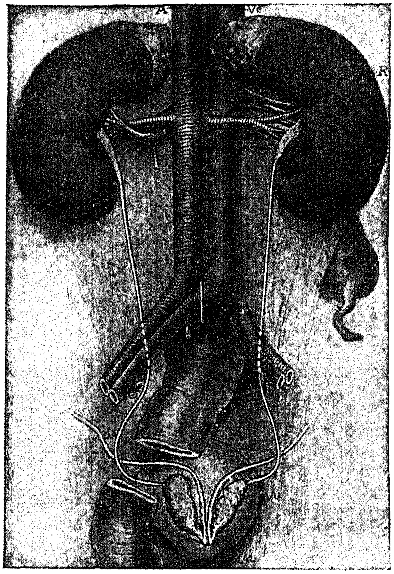

Fig. 122.—The kidneys, ureters, bladder, and their vessels viewed from behind: *R*, Right kidney; *U*, ureter; *A*, aorta; *Ve*, vena cava inferior; *Vu*, bladder; *Ua*, commencement of urethra. (Campbell.)

albumin. The action of these glands is increased during exercise. Although many substances may be found in perspiration, the amounts are very small. The function of perspiration is primarily a heat regulating function and only incidentally eliminative.

The Kidneys.—The kidneys (Fig. 122) are paired organs situated at the rear of the abdomen. From each leads a tube called "the ureter" that empties into the bladder, a

muscular bag that lies in the pelvic basin. Blood supply to the kidneys is particularly rich, and an elaborate system of vessels within the organs distributes blood thoroughly to the excretory cells.

The excretory cells of the kidney take out of the blood waste materials and water. These constitute the urine which is transferred by the ureters to the bladder. The amount of urine excreted in twenty-four hours varies with the amount of water ingested, temperature and humidity of the air, factors influencing blood pressure, food and drugs taken, and certain other factors.

The Bladder.—This organ is a receptacle for receiving the urinary secretion. The capacity of the bladder varies in the adult from 8 fluidounces to a quart. As the organ is distended, reflex nerve impulses stimulate the muscles of the wall and the organ contracts forcing the contents into the urethra, the canal of emission.

The Skin as an Index of Health.—It is a fact that the skin is an important index of health. This is so because we see in an individual more of skin than of any other tissue, and the skin responds to circulation, waste products, poisons, bacteria, very much as other parts of the body do. If the skin is healthy in appearance it represents internal health, although it is not an infallible guide. The muscles of the face, especially, indicate general muscular tone, and if the skin is sagging and flabby there, it represents usually a weak muscular tone all over the body.

Because the skin stands in the popular mind for bodily health, and because most people have the laudable desire to appear well and strong and vital, it is a practice with certain individuals to decorate the skin of the face. Some criticize this as a remnant of barbarism and cite instances of savages who practice face painting, but it is reasonable to suppose that in modern life it relates to a desire to appear attractive, to seem healthy and vigorous. It is important to emphasize in this connection that such health is only skin deep, that it fools no one, and *that the counterfeit is evidence of the absence of the real thing.* Furthermore, health comes from within and cannot be put on. It cannot be

bought in a box. The skin itself is kept healthy by proper functioning of the body with regular removal of waste, by cleanliness, by avoidance of certain poisons and foods, and of conditions that disturb the internal secretions of the body. This last point will be discussed in connection with the hygiene of the reproductive system.

The skin serves as an index of health because we are accustomed to judge health by "looks." It is true, of course, that the outward appearance is suggestive of the internal health. Persons are continually judging the health status of other persons by the way they walk or sit, by the appearance of the skin or facial expression. How often one conveys impressions of poor physical condition by the way one walks is not generally appreciated. The posture oft proclaims the man, and it is important to remember that good postures, clear skin, and happy expression are real evidences of healthful functioning of the organism at that time.

It is unnecessary to rely upon general signs in determining health. The science of medicine has advanced beyond the tongue and conjunctiva stage. The laboratory sciences are used to determine the way the body is performing its functions. The list of examinations given on pages 137–142, indicates the available scientific procedures that may be used to determine the cause of ill health. Many of these procedures naturally relate to the eliminative system because many of man's errors in living show so quickly in disturbed elimination. To care properly for this system is a matter of importance.

Care of the Skin.—So far as organic health is concerned, it is probably true that bathing is not essential to health. There are numerous examples of people who live long and are peculiarly free from disease without bathing, except perhaps at very infrequent intervals. But the modern conception of health always involves something more than mere freedom from disease, and in this matter as in others the significance of the indirect and reflex influences of procedures upon mental attitude, outlook, and sense of bodily well-being must not be missed. One of the values often

associated with exercise is the shower that follows the activity. This is serviceable not alone because of the removal of dirt, but also because of the reflex, stimulating effects upon the nervous system.

The external layer of the skin is made up of many scale-like cells packed very close together. These outermost cells are dead and are continually shed from the surface of the body. Held together by the sebaceous matter from the oil glands of the skin, they form with the dirt that collects upon the body a pellicle that covers the openings of the perspiratory glands. The oil glands and perspiratory glands are continually pouring their secretions upon the surface of the body. To remove this waste accumulation it is very desirable that bathing be made a regular and frequent habit.

The Warm Bath.—The warm bath (from 90° to 98° F.) is essentially a cleansing bath. The heat causes dilation of the skin vessels with resulting redness of the skin and increase in perspiration. The warm bath produces relaxation of the muscles and is particularly beneficial after fatiguing labor. It soothes the individual and is conducive to sleep and rest. For some, however, the warm bath is stimulating and should not be taken before retiring. This effect of stimulation is liable to occur if a hot bath is taken (over 98° F.).

The Hot Bath.—The hot bath (over 98° F.) should be taken only if prescribed by a physician.

The Cold Bath (under 65° F.).—Bathing in cold water is becoming more and more popular, due largely to the pronounced beneficial effects. It should be performed in the morning on arising because of its stimulating action but it should not be used in any regular fashion to stimulate one who is always tired on arising in the morning. The cold water acting upon the nerve endings in the skin arouses them to increased activity, causing constriction of the vessels (to be followed subsequently by dilatation) and a wholesome stimulation of the nerves. For one who is rested and ready for the work of the day, such stimulation may be indeed wholesome.

The ideal method of taking the cold bath is by means of the shower; bombardment of the skin by the dashing particles of water is markedly beneficial in addition to the effect of the cold. Moreover, the shower is a much more sanitary affair than the tub.

The tub, though, is available to more people than the shower, and it may be used effectively to secure all that is essential. The procedure for the cold tub should be as follows: Fill the tub from 12 to 14 inches with water as cold as can be borne. For men the tub may be filled during the shaving process. Before entering the tub wash the face and neck with cold water. If desired, certain parts of the body may be cleansed with soap and warm water. One is then ready to enter the cold tub. It is important to proceed according to directions. Step into the tub and sit down, allowing the water to come over the legs and thighs. At once lie back so that the water rolls over the chest and shoulders. Immediately get out of the tub and rub down with a coarse towel.

The normal result of the cold bath is to drive the blood from the skin vessels to the internal organs. On emerging from the bath the vessels of the skin dilate, the skin becomes flushed, and a pleasing sensation of warmth follows. This is called the reaction. If reaction does not occur, this is an indication that the bath is not suited to the individual.

For those who can bathe in cold water there are distinct health benefits. Most people, except the aged, can indulge in this form of bathing the year around if the practice is started in the summer, and if a warm bathroom is available. Some people say that they cannot take a cold bath because of the shock to the nervous system. On the contrary, it may be noted that the majority of people with profit to health can and should practice the cold bath daily. In addition to serving, for some, as a protection against colds it remains a procedure with marked wholesome effects upon the general health, promoting appetite, digestion of food, and improved mental activity. The cold bath should be taken before breakfast; the warm bath before retiring. A complete body bath should never be taken until at least

two hours after a meal, and preferably three. The best time, of course, is before eating.

Lusk states, "Cool baths and winds increase the metabolism which must be effected through the chemical regulation." The effect of baths and douches lasting three and a half to five minutes is given by Lusk,[1] who refers to the work of Rubner. "When the water has a temperature of about 16° C. (about 61° F.) he (Rubner) finds that the carbon dioxide elimination may be very largely increased, especially in the case of the douche. The effect of the douche was more marked if taken before breakfast when the intestinal tract was free from food. The results before breakfast were as follows:"

INFLUENCE OF COLD BATHS ON METABOLISM IN MAN

	Douche 16° C. Increase, per cent.	Bath 16° C. Increase, per cent.
Volume of respiration........	54.5	22.9
Carbon dioxid excreted........	149.5	64.8
Oxygen absorbed............	110.1	46.8

This increased metabolism lasts about one and a half hours. The cold bath, by diminishing body heat and by increasing metabolic processes, is a desirable procedure for a person who is overweight.

Substitutes for the Cold Shower or Tub.—If the tub or shower is not available, or if the physical condition does not warrant the full bath, the cold sponge bath should be employed. There are few persons in America who cannot take advantage of this procedure. A sponge as large as a quart can should be used. Saturate the sponge with cold water and squeeze over the arms, chest, back, and legs. Follow with a vigorous rub of the entire body with a coarse towel.

For those who have not the facilities for the above, washing the face, neck, and chest with cold water may be found helpful in protecting the body against cold.

[1] Lusk, G.: The Science of Nutrition, W. B. Saunders Co., Philadelphia, 1919, p. 144.

Foot Infections from the Bath.—In using showers, locker rooms, and pools of public institutions many people acquire an infection of the feet caused by the ringworm fungus. This fungus grows well in moist, warm areas and hence attacks most frequently the area of skin between the toes and especially between the fourth and fifth toes. The course of the infection tends to be chronic with periods of relief. The fungus forms spores, however, that may live for months and hence after a period of freedom from the disturbance, the condition may develop anew. In a study at the University of California in 1928 of 3100 freshmen students, 53.3 per cent of the men and 15.3 per cent of the women showed clinical signs of the disorder. In preventing the infection, one should always wear a foot covering in locker and shower rooms. The feet should be washed daily and the nails and toes kept scrupulously clean. If infection takes place, one should consult a physician.

The Habit of Bathing.—The great thing in all education for health is to establish habits. Much of the routine care of the body involves at first considerable effort of will and careful planning of the day's program. The chief point of importance in forming a habit, as James has so well pointed out, is to permit no exception to occur. This instruction is particularly important in cold bathing. Permit no exception. Begin in the summertime; day in and day out follow the program.[1] In several months the habit will be fairly started, and after a year's experience the body will have become so accustomed to the refreshing and stimulating reaction that the habit could hardly be given up at all.

Other Forms of Bathing.—Sea bathing is held by many to be especially beneficial to health. The virtue ascribed, usually, is in the salt of the water. In this connection it should be noted that salt is not absorbed through the skin, and that if salt were the efficacious agent then sea baths could be taken at home by purchasing sea salt. Salt baths may be taken in this way, but the values of transporting the ocean to the apartment are psychologic, if any at all.

[1] It will be necessary for some women to interrupt this schedule during the menstrual period.

The real values in sea bathing are to be assigned to other factors. The outdoor air, the usual sunshine, the happy companions, the play and sport on the beach—these are the great tonics, the real cause for the exhilaration and bodily well-being that come from a swim in the ocean. A business firm specializing in sea salt would try to convince otherwise; this is because they have salt to sell and are not able to sell pleasurable recreation, pure outdoor air, and sunshine.

It is important not to stay in the cold water of the ocean too long. If the body feels chilly it is time to come out and get a good rub down. Probably for most people twenty minutes is the limit in time to be allowed. Certainly, blueness of the lips or fingertips indicates that the heart and lungs are meeting with difficulty the body needs; the intelligent person will not disobey such signs.

The *Turkish bath* is a form of bathing available usually in large cities only. The Romans in the later days of the Empire engaged in many of the procedures used in the modern Turkish bath. This form of bathing is well borne by most people, and although to be classed as a luxury and in no sense a real necessity for living healthfully, it is valuable after severe physical exertion, and for certain types of muscular and joint conditions following rheumatism.

The *Russian bath* is similar to the Turkish, but differs in providing hot vapor instead of hot air. This type of bath is recommended often for certain dry forms of bronchitis and chronic laryngitis.

The *sun bath* indicates, by its name, that the body may be bathed without water. We may consider logically, therefore, exposure of the body to the sun and air as in effect a bath. For some years sunlight has been used, especially in Switzerland, for the treatment of bone and joint tuberculosis. The extension of physiotherapy, especially since the World War, has emphasized anew the value of the sun's rays in stimulating metabolic processes, and particularly the formation of hemoglobin. Thus, the sun bath is to be considered as a valuable hygienic measure, improving nutrition and general health. Exposure to the sun's rays should be, for brief periods, very gradually extended. If the exposure

is overdone, sunstroke may occur. Not infrequently, people on vacations suffer with headache and general debility from too much exposure to the sun.

The Complexion.—The care of the skin of the face presents to many persons serious problems. The complexion is important as a matter of justifiable personal pride. Some of the fundamental facts in relation to the complexion are given below:

1. The complexion is an indication of internal bodily states. Pallor, flabbiness, blotches, pimples, discolorations, enlarged blood vessels, floridness are signs of habits of living and of the general health.
2. These unfavorable and undesirable signs are to be removed (when possible) by correcting the errors in living, by removing the cause.
3. The quality of the skin in different individuals varies so greatly that a preparation effective for one person may be injurious to another. The dry skin and the oily skin require care of a different kind.
4. Local conditions may injure the skin of the face and result in constant disturbance until the conditions are removed.

Unless one works at a dirty or greasy occupation the face should not be washed with hot water and soap. For most persons, it may be said, that washing the face three times daily in cold water is sufficient for cleansing purposes. The cold water tones up the elastic tissue in the skin, improves the circulation, and is a deterrent to the appearance of wrinkles. With the exception noted above soap should not be used. The hope that many people have in medicated soap is directly proportional to their belief in the mystical and the magical, and to their reading of promising advertisements. No justification exists for any reliance on medicated soaps. As a rule, their virtue lies chiefly in their odor or appearance. One soap claims to be a health soap because of the presence of carbolic acid; another seeks preference because it is impregnated with the salve that is to be used with it; all rest their case upon unwarranted and unscientific claims.

The following advertisement of a "skin beautifier" illustrates the tendency to be combated: ". . . makes the skin transparent. Blemishes of every kind disappear as if by magic."

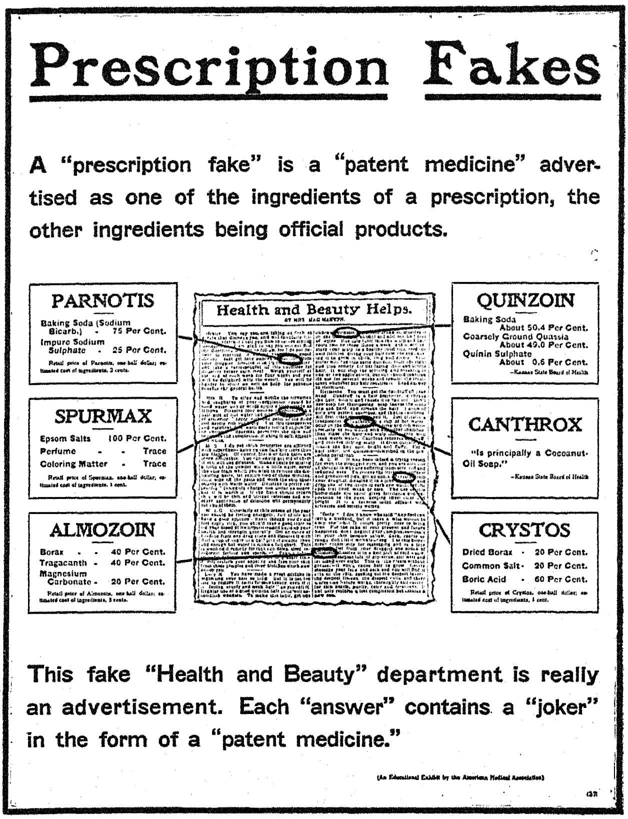

Fig. 123.—Newspapers publishing such health columns should receive the condemnation of all advertisers of honest products. (By courtesy of the American Medical Association.)

This "beautifier" on analysis gives: Zinc oxide, 7 per cent; bicarbonate of soda, 5 per cent; glycerin, 10 per cent, and water, 78 per cent. The ingredients cost about 4 cents;

the preparation sells for 50 cents. This profit will buy seats at the "Follies" for the manufacturer; the skin often remains unbeautiful.

People today too often desire magic in medicine. To such superstitious minds the "medicine man" speaks with more authority than the scientific physician. They long for buncombe. This tendency is capitalized by the patent medicine interests who for simple compounds of soda and borax use elaborate, meaningless, but mysterious names.

Frequently cosmetics are advertised under fake columns (Fig. 123) in second rate newspapers, as "Answers to Correspondents," "Health and Beauty Advice," or "Health and Beauty Helps." In one such column the following appeared:

"Lucile. A good 'liquid powder' or face wash is made by dissolving 4 ounces of spurmax in ½ pint of hot water and adding 2 teaspoonfuls of glycerin. This home-made complexion beautifier whitens the skin without the use of powder and is particularly recommended for anyone who has a sallow, dark, or oily skin."

On careful chemical analysis, spurmax is found to consist of

Crystallized magnesium sulfate (Epsom salts)	100 per cent
Perfume	trace.
Coloring-matter	trace.

The retail price of spurmax is one-half dollar. The estimated cost of the ingredients is less than one cent.

The necessity for all persons understanding the nature of the skin, its needs and functions, stands out as an imperative demand in these days of such blatant and unshamed lying in advertisements.

If a soap is used for cleansing the face, the only desideratum is that it be pure and nonirritating. For persons with an oily skin or persons living in cities where the air is filled with soot, the daily use of soap may be necessary; but pallor is to be corrected by improving the quality of the blood, flabbiness of the skin by exercise and cold baths, blotches and pimples by medical advice and guidance when hygiene alone has not sufficed.

If the skin is unusually dry, a little oil may be applied. In hot weather a little powder may be welcomed. Certainly, if used sparingly, there can be no harm; its use is a matter of taste.

The use of hot water on the face and subsequent exposure to cold air or wind usually result in chapping. In "make-up" for dramatics it is important to apply a plain cream to the face before the paints or charcoal are used. This permits their easy removal and prevents clogging of the openings of the glands with irritating substances.

Care of the Hair.—The hair grows from follicles in the skin. At the follicle the hair cells are alive, the growth occurs in the follicle, and the hair is pushed out. The ends of the hair are dead and resemble the outer layer of the skin in this respect. This physiologic fact should be borne in mind when singeing is proposed as a method "to prevent the hair from bleeding." The scalp has numerous oil or sebaceous glands which pour out their secretion near the roots of each hair follicle. This secretion keeps the hair oily and prevents breaking. Individuals vary in the amount of oil produced by the scalp; some scalps are dry, others are very oily.

The hair should be cared for as a part of the general plan to keep one's self clean, well groomed, and in good condition. The loss of hair or dirtiness of the scalp may have nothing to do with digestion of food, but it is to be noted that health is a complex matter associated with indirect as well as direct factors. Reasonable care and attention to the body results often in reflex mental states of optimism and cheer, in wholesome ways of looking at problems, in consciousness of power, that are immensely valuable to society as well as to the individual. Shampooing the hair should be performed whenever the hair and scalp are dirty. For some with oily scalps this may mean once a week; for others with dry scalps, two or three week intervals will be desirable. For the shampoo, any good toilet soap may be used. There is no special value in the advertised products. A good shampoo liquid soap is the official *linimentum saponis mollis.* This may be purchased at any drug store. It contains 50 parts of soft soap, 2 parts of oil of lavender, and 33 parts of alcohol.

After thoroughly washing the hair and vigorously massaging the scalp with the fingertips, the soap should be entirely

removed by frequent douching. In winter one should always end with cold water. The hair should then be thoroughly dried, and particular attention should be paid to drying the hair at the back of the neck and around the ears before going out-of-doors.

If the scalp is found to be particularly dry after shampooing, it will be advisable to add a small amount of oil or grease. For this purpose, pure liquid vaselin will be found very good. Some advise olive oil. The addition of the oil prevents cracking and breaking of the hair and scaling of the outermost cells of the scalp.

Daily massage of the scalp will improve the circulation and favor the growth and luster of the hair. The procedure of the hostler in caring for his horse may be an example applied here. The hair will be maintained in good condition by keeping it clean and by frequent brushing.

Care of the Nails.—The nails are similar to the hair in that they are growths from the skin. A Chinese custom, gradually disappearing, is still found, especially among Chinese students, who wear the nails long and pointed, indicating that they have no need to do physical work. The condition of the nails is a sign of the care given to the body by the individual American just as truly as the long nail is a sign of the vocation of the Chinese. Clean, well-kept nails may be considered with other items of personal hygiene as representative of the interest of the individual in maintaining an optimum physical state. That some persons give more attention to the care of the nails than they do to the care of the nervous system is merely a sign of the uninformed character of the latter and the mixing of values; it does not mean that the nails should be neglected.

The cuticle surrounding the nail should be pressed back once or twice a week with an orange stick. If excessively dry, the cuticle may be softened by applying pure liquid vaselin at night before retiring. Unless the cuticle is cared for in this way "hangnails" are liable to form and may give rise to serious infections. The surface of the nail should never be scraped.

The nails of the fingers should be shortened when neces-

sary by filing. The toenails should be cut straight across, to prevent ingrowing of the nails.

Care of the Hands.—The hands are always contaminated with bacteria. Numerous experiments have shown that it is very difficult to sterilize the hands and nails, even after scrubbing with soap, hot water, lime and soda, and soaking in bichloride. The fingers contain in the folds of the cuticle and under the nails always a varying amount of débris that is bacteriological. A typical sample shows various cocci, particularly streptococci and staphylococci, colon bacilli and spirillae, yeast cells and other fungi derived from the mouth, soil, food, body surface, water, nose, eyes, sewage, dust, dirt, etc. In a recent series of tests by Bruce[1] colon bacilli were found on the hands of food handlers, while at work, in 8.37 per cent of the 337 tests.

It would seem that these were significant facts if they helped one to prevent infection by the hands. To prevent such infection there are at least two important notations:

1. Clean hands for all first-aid services. In bandaging wounds, or attending to any injury of the skin, first clean the hands as thoroughly as possible with soap and hot water.
2. Prevent auto-infections. Because of the varying uses to which the hands are put, and the nature and conditions of the objects handled, the hands are always dirty, *i. e.*, they harbor bacteria. So long as the skin of the hands is not broken, these bacteria cause no disturbance if they are not transferred to the mouth, nose, or to an opening in the skin of the body produced by scratches or cuts in its epidermal covering. It is important, therefore, to indicate the ways in which the hands carry bacteria.

   (*a*) Scratching the body with the nails.

   By scratching the body with the nails the skin may be broken and a direct infection results from the infected nail. In this way lupus, acne, boils, and

[1] Bruce *et al.* Bacterium Coli on Hands of Food Handlers, *Journal American Medical Association*, April 23, 1927.

carbuncles have been transmitted. In this way also a disturbance in one part of the body may be spread widely over the body, *e. g.*, poison ivy.

(*b*) Biting the nails.

Biting the nails is unhygienic because of the effect on the nails, of the undesirable nervous habit, and of transmission to the mouth of bacteria from the fingers.

(*c*) Putting fingers in the mouth.

It has been stated by Chapin that if the salivary glands secreted indigo, this world would be a blue place indeed. His reference strikes at a very common and reprehensible practice. It is seen among persons who moisten their fingers with saliva to turn the pages of book or magazine. Conductors engage in this universal trade as they give out transfers. It should be stated, therefore, that nothing should be put into the mouth except clean food and clean drink.

Some people develop phobias relating to this fact of contamination of the hands. Such persons refuse to handle money without gloves and build up a number of similar prohibitions that are senseless and foolish.

Pointed Paragraphs.—The great variety of practice in the hygiene of the skin, hair, and nails, and the many questions asked by students suggest that pointed directions be given to set forth in concise fashion the best judgments on many questions:

1. Hair tonics have no special value. Health of the hair depends upon the general health and the blood supply in the scalp. It may be desirable to have a special prescription. This should be given by a physician and based upon the local condition.
2. Daily massage of the scalp and frequent shampooing to keep the hair clean are the best tonics to be applied locally.
3. There is no danger from frequent shampooing of the hair. The mechanical stimulation is very beneficial. If excessively dry, a little oil may be added.

4. The cold bath in the winter may produce an itching of the skin of the legs. This bath pruritus is seen in persons with an excessively dry skin. The condition may be controlled by oiling the parts affected after the morning bath.

Singer Treated for Gray Hair Sues for $25,000

Mrs. Gertrude Bianco and Her Husband Seek Damage From Specialist

Mrs. Gertrude Bianco, of 316 West 122d Street, a concert singer, alleging that she was blind for several days, the glands in her neck swollen and lumps developed on her head, following treatment to restore gray hair to its natural shade, filed a suit for $25,000 damages in the Supreme Court yesterday against John Andre, of 57 West Thirty-ninth Street. Attilio Bianco, husband of the plaintiff, also filed a suit for $5,000 damages against Andre for loss of his wife's services. Mrs. Bianco says she called on Andre on December 26 in company with a friend who had recommended the defendant as an expert in the treatment of the hair. Andre, it is alleged, assured Mrs. Bianco he could make her gray locks black again, and in such a manner that neither salt water, steam nor hair lotions would tarnish them.

The plaintiff submitted to the treatment. In a few days, she claims, all the things happened to her of which she complains, she was in great pain, besides being incapacitated for some time, and suffered financial loss.

Fig. 124.—The use of dye preparations for the hair is frequently dangerous.

5. It is advisable for men to shave themselves. Troublesome and obstinate skin diseases are not infrequently contracted in public barber shops. The damp towel, or shaving brush, is usually the medium of infection.
6. Shaving of the head to promote growth of the hair is a useless procedure.

7. Curling the hair on pins or papers is not injurious, but procedures used to produce a "permanent wave"[1] make the hair unusually dry and brittle, and destroy the "life" and luster of the hair.
8. Hair removers should be used only upon the advice of a physician. One sure method of removing superfluous hair is by electrolysis. This requires a specialist skilled in the technic. Painful and serious abscesses are caused at times by crude methods of removing the hair from the armpit.
9. It has been said that the only sensible thing to do for gray hair is to admire it. Some persons are unable to face the problem as squarely as that. If dyes are used, great care should be taken that they do not contain lead, for serious results frequently follow in the form of lead poisoning. The above item (Fig. 124) in the New York Tribune of August 8, 1920, indicates the danger of such treatment.
10. Perspiration checks depend for their action upon salicylic acid. The well-known Thiersche's powder is the foundation of most perspiration remedies. It contains salicylic acid 1 Gm. and boric acid 10 Gm.
11. Most deodorants depend upon aluminum for their effect. Odor-o-no, Mum, and others widely advertised are very simple preparations, perfumed, and given names that advertise easily.
12. There are numerous depilatories on the market. They are dependent for their action upon barium, calcium, or sodium sulfide. Analyses are given in Nostrums and Quackery, Volume II.
13. If the hands are always washed carefully before eating and if fingers are carefully kept out of the mouth and nose, and if the body is not scratched with the nails, the bacteria and other dirt that accumulate on the hands may be considered as harmless.

[1] It is interesting to note that Negroes use preparations to take out the kink in the hair and the white race (women) employ numerous measures to achieve a curl or wave.

The Clothing of the Body.—The rôle of clothing in modern civilization appears in an uncertain light when one observes furs in summer and the thinnest of silk stockings in winter, or when the young child with bare legs is exposed to the cold harsh winds of winter or early spring. Are these feminine foibles of no moment? Is clothing to be judged by style merely? Are wholesomeness and beauty forever at odds in human dress? There lies in this very problem of clothing the real heart of the problem of health. The hygienic knowledge is available, but it must compete against selfish and foolish attitudes, unworthy life goals and guides. Here as elsewhere the problem of living finely and well consists in the utilization of scientific fact, of demonstrated truth. The willingness to sacrifice health for high heels, to waste in crude and vulgar ways the affective values of life for momentary popularity, to let the race take care of itself, are attitudes that must give way before the dominant sense of the social and moral responsibility for living at one's best. The hygiene of clothing also demands, therefore, at the very outset the application of scientific fact.[1]

Seasonal Clothing.—Clothing should be used as a protective covering for the body and should fulfil the demands of the body as regards heat conservation or dissipation. For civilized man only about 20 per cent of his surface is normally exposed to the air. For protecting the body against cold, clothing that holds air in its meshes is most satisfactory. Rubner has shown how valuable fur is because of this quality. He cites the fact that the hair of the black cat, black lamb, rabbit, skunk, raccoon, mink, musk deer, and sheep weighs very little itself, but the fur contains so much air that it may be said to consist by weight of 97.3 to 98.8 per cent of air, and only from 1.2 to 2.7 per cent of hair.

Hot weather clothing that will permit circulation of air and yet that will absorb moisture is very important. Garments that do not take up moisture but allow perspiration to collect on the surface of the body are highly unsatis-

[1] Bibliography on the Relation of Clothing to Health. Department of Agriculture, Washington, D. C. Miscellaneous Publication, No. 62, November, 1929.

factory, because in times of high temperature evaporation is retarded, and hence cooling of the body is interfered with; and at low temperatures a great amount of heat is lost by conduction through the moisture, and hence there is rapid chilling of the body.

Clothing has marked influence on metabolic changes occurring in the body as given by Lusk,[1] who uses Rubner's figures:

INFLUENCE OF CLOTHES ON METABOLISM IN MAN AT A TEMPERATURE OF 11° TO 12° C. (ABOUT 52° TO 53° F.)

	CO_2 in grams per hour.	H_2O in grams per hour.	Remarks.
Summer clothes	28.4	58	Cold, occasional shivering.
Summer clothes and winter overcoat	26.9	50	Chilly part of the time.
Summer clothes and fur coat	23.6	63	Comfortably warm.

This is the sort of scientific evidence from which the hygienist determines his rules. It will be observed that the individual with "summer clothes" had to burn more food material, as indicated by the greater CO_2 output, than the individual who wore "summer clothes and winter overcoat" or the one dressed with "summer clothes and fur coat." This means, of course, that children and women, who are chiefly concerned in this matter, are losing valuable body heat by lack of proper protection of the body. It thus becomes a matter of prime importance in health that the body heat be conserved, that the losses of heat be prevented. This is of particular importance on cold, windy days because of the greater loss at such times.

Men who spend the days indoors in heated apartments and offices will find it convenient and practical and healthful

[1] Lusk, G.: The Science of Nutrition, W. B. Saunders Co., Philadelphia, 1919, p. 149.

to use light-weight suits, and in cold weather to secure the additional protection by a suitable overcoat. Women are less easily provided for because of the widely varying types and quality of clothing used. The principle to be applied by each person, however, is that of adequate protection from cold in winter and freedom from moisture on the body in summer. City persons living indoor lives will find it desirable to have for out-of-door or sport wear durable clothing that will not only be suitable for physical activity but also serve adequately the temperature and climatic changes.

The farmer, the truckman, the outdoor worker generally will find it essential in cold weather to wear woolen next to the skin. This is admirable for two reasons: it is very absorbent, and hence it takes up the perspiration, and it prevents rapid evaporation, and hence it is warm.

Old persons and children will find it very satisfactory to use woolens in winter. For summer wear, light cotton fabrics are very satisfactory. Silk is usually expensive, but is always soft and cool.

The color of clothing is of high importance. White and all light colors absorb fewest of the heat rays and thus are more suitable as colors for summer wear. White is preferable to colors produced by cheap aniline dyes. Such dyes at times cause marked irritation of the skin.

Underclothing.—Underclothing is essential to protect the outer garments from the perspiration of the body, and to provide a covering that may be readily washed, kept clean, and changed to meet the temperature and seasonal changes. Underclothing should be changed frequently. This necessity varies with the amount of perspiration of the individual. When taken off at night the underclothing should be placed over a chair in such fashion that it will be thoroughly aired. Damp underclothing should be changed at once, and especially if the day is windy or cold. Soiled underwear favors the development of micro-organisms which produce at times annoying skin diseases.

Fortunately, women of the present day need little instruction in the matter of tight lacing of corsets. The old days of the wasp waist are gone—let us hope—forever. It is

held by some that women would be healthier if they did not wear corsets, but this is conditioned upon other matters, such as support for clothing, proper exercise involving the trunk muscles, and childbearing. The more flexible corset or waist so popular today is generally desirable.

How to Wear Clothing.—The average woman who will wear dresses and undergarments supported from the shoulders or hips, who will be physically active, and who will allow at least two years to elapse between pregnancies, will be healthier and happier without a corset. For those who wear skirts supported at the waist a light corset will be found very helpful.

The hygienic principle to keep in mind in corseting the trunk relates to the height, rigidity, and fit of the garment. The corset should be low and flexible. It should fit snugly over the hip bones and give support to the lower third of the abdominal wall, exerting a force upward and backward. In no case should the corset be permitted to compress the waist or lower chest. It is important in this connection to emphasize the value to the wearer of the corset of standing away from the corset and not permitting herself to hang on the corset as a support.

Unfortunately, men of the present day are victims of a custom in clothing that is injurious in a similar way as is the corset for women. Discarding suspenders for supporting the trousers, men today in large numbers wear belts. Because the trousers are often cut high to complete the dressing joint with the vest, the belt is tightened around the waist. This causes an undesirable constriction. It is important, therefore, if a belt is worn to support the trousers that the bearing of the belt come on the hip bones of the pelvis and not above. An observation of the position of the belt in laborers doing heavy work, such as trenching, will indicate the superior value of the low position.

All tight and constricting clothing should be excluded if one seeks to secure maximum health and efficiency. Garters worn around the legs will, if too tight or if worn above the knee especially, constrict the blood vessels and impede the venous return. The growing practice among women of

having garters attached to the corset or underclothing is admirable in this connection, but it should be remembered that the point of attachment should be at the side of the hips rather than in front. The front pull exerts a traction upon the pelvis tending to produce an increased lumbar curve, or hollow back, with all the attendant ills and discomforts. For men, the usual garter to support the socks is not bad if not worn too tight. The sense of freedom and exhilaration that comes at times when, in sport or camp costume, one omits the usual garter, is an indication of the value that would come by the provision of a support for men's socks that would be practical and yet not constricting. Socks with elastic tops are available today.

Collars should never be worn tight enough to constrict the surface blood vessels of the neck. Headaches not infrequently result from tight collars. It is advisable for men to wear a collar $\frac{1}{4}$ inch larger than the size of the shirt band.

Socks and stockings should be large enough to permit free movement of the toes. It is important to change them frequently, especially in summer. When tired, it is very helpful to change the shoes and stockings. Bathing the feet after fatiguing work is very refreshing. If there is excessive perspiration of the feet with an offensive odor, it will be found helpful daily to bathe the feet in cool water, dry, and dust on the feet a powder of salicylic acid, 1 part, and starch, 4 parts. One may use to advantage a powder of equal parts of alum and talc. This powder should be dusted also into the socks or stockings, which should be put on fresh every day.

Elimination of Body Waste by the Kidneys.—The kidneys are two glandular organs that remove from the blood excess water and waste materials. About 3 to 4 pints of water are removed daily. The waste is in the form of urea, uric acid, creatine, creatinine, phosphates and sulfates of calcium, sodium and potassium, together with other complex chemical compounds. Efficient action of the skin makes less strenuous the demands upon the kidneys. The waste materials removed by the kidneys are chiefly the end-

products of protein metabolism. Diets rich in protein increase the work that the kidneys must do. Urea is increased with muscular exercise; with a decrease in the normal action of the kidneys, the urea in the sweat is increased.

Keeping the Kidneys Efficient.—There should be proper care of all the following factors influencing the kidneys:

1. Rational diet: The body should not be overburdened with protein, and particularly nucleoprotein food. Inadequate combustion, with greater waste, results from overeating (especially of protein), just as inadequate combustion with clinkers results from putting too much fuel in the furnace. This waste in the body must be removed by the kidneys.

   In addition, it is to be remembered that irritating foods and highly seasoned foods are undesirable.

   The need for keeping the protein and particularly the nucleoprotein content small has been mentioned. Meats should not be eaten more than once a day. The difference chemically between the red and white meats is in the greater amount of purine bases yielded by the former; the important point, however, is to keep the total protein intake below 100 Gm. daily.
2. Sufficient water must be drunk to keep the kidneys flushed out, to dilute the waste, and to prevent the irritation that results from the concentrated urine. At least one glass between meals, one with each meal, one before retiring, and one on rising in the morning, should be taken.
3. Free action of the skin: Exercise, prevention of chilling the body in winter, and appropriate light clothing in summer are important.
4. Exercise: The exercise should not be too severe. It has been found that vigorous athletics produce an albuminuria, but whether it is transient or represents a permanent injury to the cells of the kidneys is not known. It is important to observe moderation in athletics.

Injury of the Kidneys by Disease.—Because the kidneys are eliminative organs it falls to them to act as poison and toxin removers during disease. It is, therefore, a prudent act and often a vital matter to protect the kidneys during disease, and more intelligently, to prevent the disease, if possible, and to avoid the risk of renal injury. The kidneys are liable especially to injury in scarlet fever, typhoid fever, malaria, and in all the infectious diseases. One imperative reason for relying on medical skill at these times rather than on the unscientific and banal pathies, is to forestall serious kidney disturbance by accurate diagnosis and preventive treatment. Figure 25 shows the destruction of kidney cells in Bright's disease, a prominent cause of death.

Kidney Remedies.—"Kidney troubles" are frequently treated by means of patent medicines. This happens because of the prevailing ignorance regarding the physiology of the renal system, and the lack of understanding of the kind and nature of renal disturbances, combined with the tendency to expect pills, decoctions, and mixtures to restore diseased tissues to normal condition.

In the first place it should be pointed out that kidney disease does not, as a rule, cause a pain in the lower back. Lumbar pain in women is more frequently due to displacements of the uterus or disturbance of the tubes or ovaries; in both sexes pain in the lower back is not infrequently due to weak or flat feet and to improper shoes.

Again, it should be remembered that the bladder is only a receptable for the secretion of urine. Painful or burning micturition does not represent kidney disturbance, but usually represents an inflammation of the bladder that may be due to infection or to irritating substances eliminated by the kidneys.

An illustration of the fraud and quackery in patent medicines of the kidney-cure type is exhibited in the parallel (Fig. 125) of the advertising claims made by the manufacturers of Swamp Root in England and in America in 1912. The British labels were the same as those used in this country before the Federal Food and Drugs Act.

The general value of testimonials used by the "patent

medicine" business is indicated in Fig. 126. Doan's Kidney Pills are widely advertised, with similar endorsements—*i. e.*, those of persons dying of kidney disease.[1]

Treatment of kidney disease must be based upon diagnosis of the condition present. When physicians who have given years to the study of disease, who have at their command the chemical laboratory, microscope, and *x*-ray, still find it exceedingly difficult at times to determine the exact

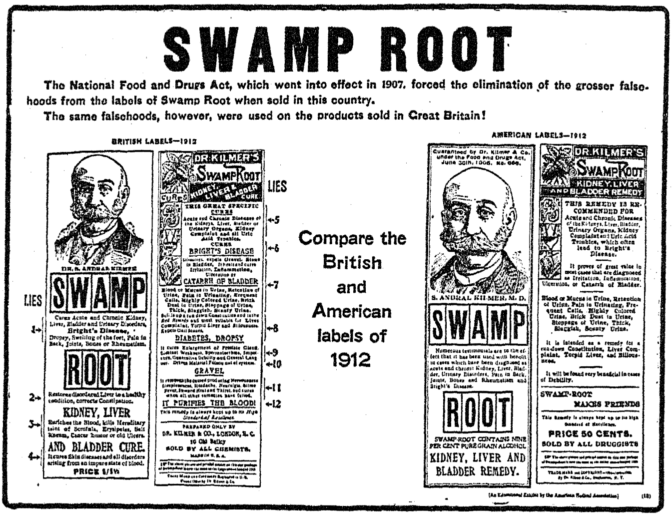

Fig. 125.—In Britain Swamp Root is a cure, in America it is a remedy. Lying on the trade package is permitted in Great Britain. (By courtesy of the American Medical Association.)

condition, how absurd it is for one to make a self-diagnosis and to prescribe patent medicines. The kidney may be affected with tuberculosis, with tumor, with stone formation, with infection of common pus organisms, with degenerative changes as in Bright's disease, as well as other serious and subtle disturbances. Health of the kidneys is to be restored only by intelligent care in medical examination,

[1] See Nostrums and Quackery, vol. ii, pp. 186–191, American Medical Association, Chicago, 1921.

diagnosis, and treatment, and not by resort to guesswork, faith, and mysterious drugs.

Medical Examination.—As stated before, intelligent care of the human body would provide at regular intervals examination of the body. This advocacy of periodic medical examination is justified by the early detection of kidney disturbance. Diseased kidneys may serve for many years if proper measures are followed in diet, exercise, and gen-

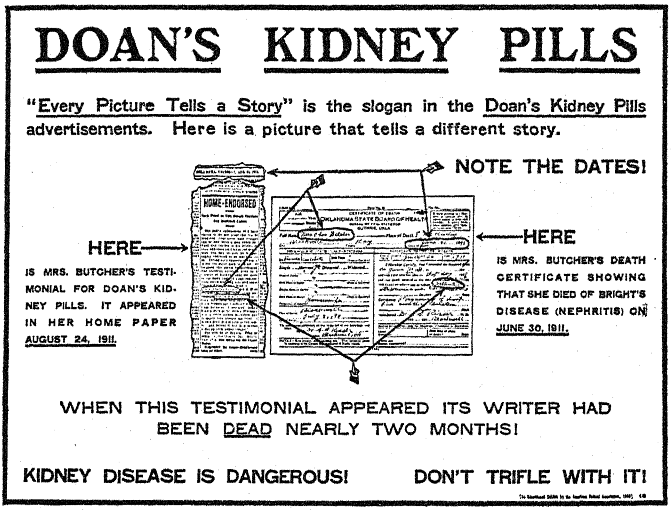

Fig. 126.—Testimonials as used by patent medicine manufacturers are usually worthless—those from the tomb particularly so. (By courtesy of the American Medical Association.)

eral living conditions. The great increase in middle age of deaths from kidney disease represents in part the lack of personal hygiene among many persons, but also the absence of any well-organized periodic examination.

The sort of work being done by the Life Extension Institute, Inc., typifies what is needed everywhere, and the kind of service, expert and medical, of which persons should avail themselves.

The periodic medical examination that leads to correction

of errors in diet, exercise, living and working conditions, may prolong active and vigorous life much beyond what we are accustomed to. Old age is a relative term. Some persons die of old age diseases at forty years; others live happily at sixty or seventy. Scientific medical examinations at regular intervals are the beginnings of intelligent care of the body.

Intestines as Organs of Elimination.—In addition to the waste eliminated by the skin and kidneys the waste of undigested food is removed by the intestines. In the former the waste comes largely from the action of the body cells; in the latter it comes chiefly from food.

Food material passing through the alimentary tract is digested, and the digested foods are absorbed into the blood stream. The undigested waste material left behind passes along the intestinal tract to be removed from the body at periodic intervals. The movement of the contents of the tract is facilitated by a rhythmic contraction of the muscular walls of the intestine. This is called peristalsis. Peristalsis is favored by exercise and by the presence of food in masses that stimulate the rhythmic contractions. The importance of food not highly concentrated, but with some waste, such as found in green vegetables, is to be recognized in this respect.

The lack of proper peristalsis and inadequate action of the intestines produces a stagnation in the tract and a condition of infrequency or irregularity in bowel action, called constipation.[1] There are many different causes of constipation, some congenital or anatomic, others purely hygienic.

Causes of Constipation.—1. Visceroptosis—a dropping down of the viscera of the abdomen is due often to bad posture. Frequently it is associated with general bodily weakness resulting from prolonged or serious sickness, but often it results from laziness and lack of proper exercise.

2. Lack of tone is found in children without enough vigor to produce peristaltic movements; it is a characteristic con-

[1] An excellent summary of intestinal auto-intoxication with valuable experimental data on constipation is given by Alvarez, W. C., *Physiological Reviews*, July, 1924, p. 352.

dition in nervous cases and neurasthenic individuals. Constipation is constant among mental patients in institutions.

3. Chronic appendicitis is associated with constipation.

4. Lack of exercise: Sluggishness of the circulation and general nutritive processes, associated with physical inactivity, are prominent as causes of constipation.

5. Improper diet: Man has an alimentary tract developed in relation to certain foods in the intestines. The foods that have played a part in determining the nature of the human intestine have been coarse foods and, therefore, a concentrated diet, refined and too easily digested, is unsuited for its action. The day will not soon come when man, for any appreciable length of time, can live fully and completely on refined food, or powdered food, or liquid food.

Various preparations are available that are designed to supply roughage or bulk material that is often lacking in the modern diet. Rose and her co-workers[1] report that the addition of 2 tablespoonfuls of prepared bran to the breakfast cereal over a period of four weeks increased laxation in 50 per cent of the cases studied. In an earlier study Rose *et al.*[2] reported that bran may contribute appreciably to the vitamin B content without adding greatly to the caloric total.

6. Pressure of unhygienic clothing as a cause, was formerly more important than it is today, but it should be stated that constriction of the waist by the belt or corset should not be tolerated.

7. Lack of sufficient water: Too little drinking of water is a frequent cause of constipation.

8. Lack of habit of emptying the bowel: The daily habit of emptying the bowel at a regular time should be developed and usually followed. This is very important in the training of children. The most favorable time, both as regards the physiologic states of the bowel and the organization of the day's program, is immediately after breakfast. It should be mentioned in this connection that a very common cause for unsatisfactory results at this time is improper height of

[1] Rose, M. S., *et al.* The Influence of Bran on the Alimentary Tract, *The Journal of the American Dietetic Association*, July, 1932, p. 155.

[2] *Loc. cit.*, March, 1932, p. 373.

the toilet seat. It is usually too high. An ideal seat would place the body in the position naturally assumed by man in primitive conditions. The seat should be low enough to bring the knees above the seat level. This may be accomplished by placing the feet on a small box.

QUESTIONS AND EXERCISES

1. List the ways by which the waste of the body is eliminated.
2. Describe the skin and give its functions.
3. How may the skin serve as an index to health?
4. State the purpose and procedure of the warm bath; the cold bath.
5. What signs indicate that one does not respond well to a cold bath?
6. How is foot infection to be avoided?
7. State the values of sea bathing.
8. State the procedure and the results of sun baths.
9. List important points in the care of the complexion; in the care of the hair; in the care of the nails.
10. How should the hands be cared for to prevent infection?
11. State existing conflicts between the scientific facts about clothing and style.
12. List qualities of clothing desirable for hot weather.
13. State effects of tight clothing upon health.
14. List functions of the kidneys.
15. State rules for keeping the kidneys efficient.
16. State purposes of an annual medical examination.
17. List causes of constipation.

CHAPTER XII

THE HYGIENE OF THE NERVOUS SYSTEM

I. Anatomical and Physiological Backgrounds.
II. Factors of Importance in Maintaining the Health of the Nervous System:
   1. Harmony of Action between Cerebrospinal and Autonomic Systems.
   2. Relation of Training to the Health of the Nervous System.
   3. Attitudes Affect Functions.
   4. The Significance of Defective Inheritance in the Nervous System.
   5. Motives in Life.
III. The Normal Mental Life.
IV. Worry:
   1. Worry over What We Have Done.
   2. Worry over What We Are Going to Do.
   3. Worry over the Opinion of Others.
   4. Worry over Health.
V. Development of Wholesome Mental Habits:
   1. Confidence.
   2. Faith in the Goodness of Life.
   3. Openmindedness.
   4. Unselfishness.
VI. Insanity:
   1. Types of Insanity.
   2. Causes of Insanity:
      (*a*) Syphilis.
      (*b*) Alcohol and Other Poisons.
      (*c*) Physical Diseases.
      (*d*) Mental Habits.
VII. Alcohol and the Nervous System.

Anatomical and Physiological Backgrounds.—It has been remarked that not a dozen people in the world understand the Einstein theory of relativity and yet Mr. Einstein in an hour could make clear to intelligent persons his notions of a finite universe. In such an explanation he would of course omit the mathematical calculations. Many persons do not understand the structure and functions of the nervous system of man and yet it is really very simple—if one omits the complex details.

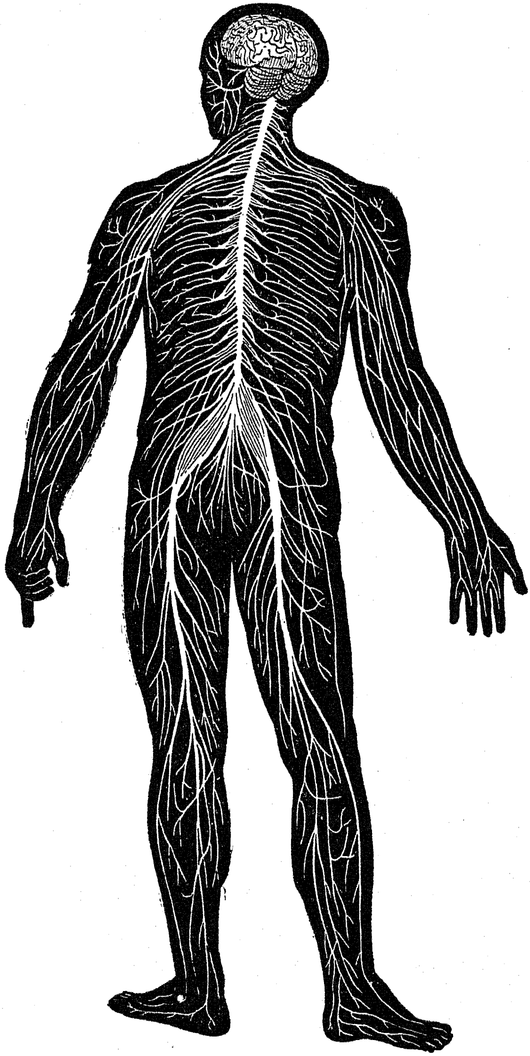

Fig. 127.—The general arrangement of the cerebrospinal nervous system (viewed from behind), showing the brain, the spinal cord, and the chief nerves that branch from it. No portion of the autonomic nervous system is shown in this diagram. (From Williams "Healthful Living." By permission of The Macmillan Co., Publishers.)

Examination of the nervous system in Fig. 127 leaves an impression of immense complexity but this is starting with what Mr. Einstein would call the mathematical calculations. A simpler approach is possible.

A Simple Nervous System.—The structure of the nervous system in man is related to the functions performed. As

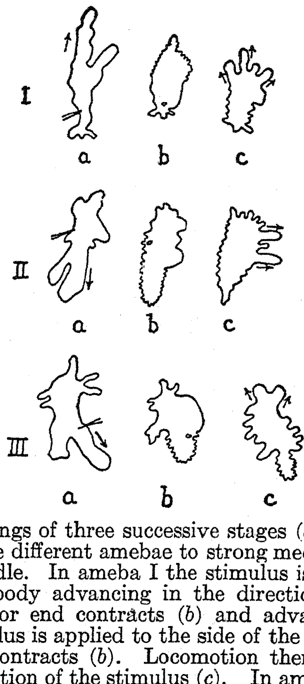

Fig. 128.—Drawings of three successive stages (*a*, *b*, *c*) of the avoiding reaction of three different amebae to strong mechanical stimulation, by a prick of a needle. In ameba I the stimulus is applied to the posterior end of the body advancing in the direction indicated by the arrow. The anterior end contracts (*b*) and advances again (*c*). In ameba II the stimulus is applied to the side of the advancing body (*a*). The anterior and contracts (*b*). Locomotion then begins in the side opposite the application of the stimulus (*c*). In ameba III the stimulus is applied near the advancing end (*a*). The anterior end contracts (*b*). Locomotion begins at the posterior end (*c*). (After Heyman (1917).) (From Herrick "Neurological Foundations of Animal Behavior," Henry Holt and Company, Publishers.)

the function of the muscle is contraction and that of the epithelial cell is secretion, so nerve cells have their characteristic functions. These may be expressed by the words, excitability, conductivity, and integration. These words seem to be the mathematical calculations that were to be

omitted, but further explanation will make the matter clear.

In the first place, nerve tissue is particularly sensitive to stimuli. In a simple ameba, an animal with no nervous system, this quality of excitability can readily be shown (Fig. 128). A needle applied to the organism is at once felt; the

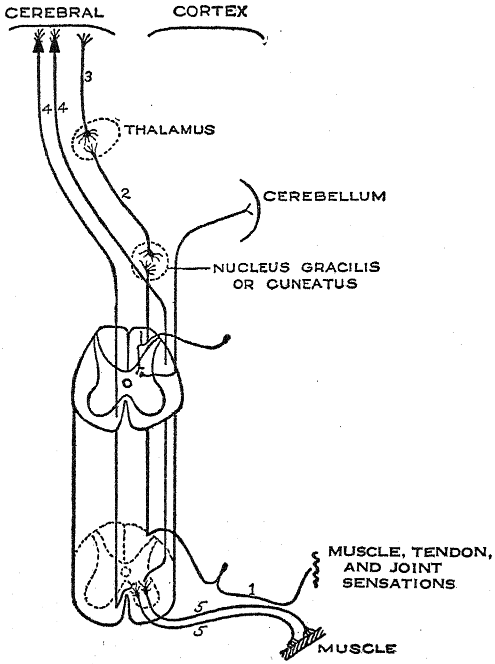

Fig. 129.—Diagram of neuron connections in afferent and efferent main pathway.

protoplasm is stimulated. This quality of being able to receive a stimulus is called excitability. Secondly, when the stimulus is received, it is then conducted to various parts of the organism. This is a characteristic quality in nerve tissue—the conductivity of a stimulus. And, thirdly, the organism acts with respect to a stimulus at a particular place. This correlation of action with respect to the situation is integration.

These functions may be further described in terms of simple wormlike animals with nervous systems. The basic structure now is a receiving structure manifesting excitability, a conducting path providing for conductivity, and a center or centers to correlate the stimuli received into an integrated response. This basic pattern is shown in Fig. 129. In wormlike animals with several body segments, the quality of integration becomes more important; indeed as structure and activity of the organism become more complex, this quality takes on added significance. By reference to Fig. 129, it will be observed that an impulse received at 1 may be sent along to centers in other levels and the response may take place at other levels. The necessity to correlate all these excitations is met by the development of central

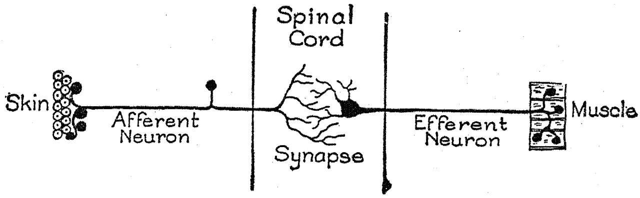

Fig. 130.—Mechanism involved in a reflex act, or a reaction of the first level. (After Gates.)

control over all centers by means of the large center in the head of the animal—the brain.

The Nervous System in Man.—The nervous system in man follows the simple pattern of an incoming stimulus, a center, and an outgoing response (Fig. 130). The head center develops into the brain. The brain, then, is the center in the head that integrates the excitations from all sources; the spinal cord is a massing of small centers and provides integration of some functions; the nerves are the conducting pathways to and from the centers; and the quality of excitability is deposited in the specialized ends of certain receiving nerves.

The Nerve Cell.—The unit of cell structure in the nervous system is a nerve cell or neuron. It consists of a cell body with quite distinctive cell processes, called the "axon" and

"dendrites" (Fig. 131). Interpreted in terms of the simple nervous system described above, the cell body is in the center (the cord, brain, or centers close to the cord and brain), the axon forms the nerve pathway, and the dendrite contains the end-organ. One nerve cell connects with another at the synapse (Fig. 131) so that an impulse received by one unit may be transferred over several cells; this arrangement provides for continuity of the impulse.

Excitability.—Intimately associated with nerve cells are certain specialized cells that serve particular functions in

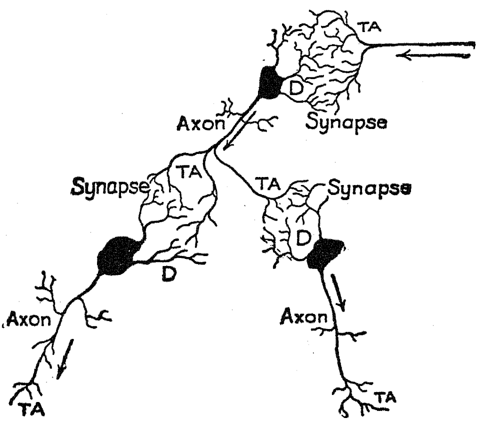

Fig. 131.—Diagram of three synapses. Nerve impulse is indicated by arrows, showing that the direction of passage is from terminal arborization (TA) of axon of one neuron to dentrites (D) of another neuron.

picking up stimuli. For example, the eye is a specialized organ to pick up light waves, the ear for sound waves, taste buds in the tongue for taste, and a certain area in the nose for smell; these endings are receptors of external stimuli. There are of course many more than those mentioned above (Fig. 132); and indeed a great variety of internal receptors also convey information to centers regarding the internal environment of the organism.

Conductivity.—The structure known as a nerve is composed of processes of nerve cells. The cell bodies lie in the

brain, cord, or in centers (called "ganglia") outside the cord. Some of these processes are conducting impulses to the cord giving information about the environment; others are conducting impulses from nerve cells in the cord or brain giving directions about the action to take—such as, close the eyes, move the arm, turn the head, secrete perspiration, cough, yawn, speak, and innumerable other responses.

If a nerve is cut, the pathway is destroyed, at least temporarily, and messages cannot pass until the pathway is restored.

Integration.—The phenomena of integration are so many, and the structure of this head ganglion, the brain, is so complex that comprehension of its mechanism requires pro-

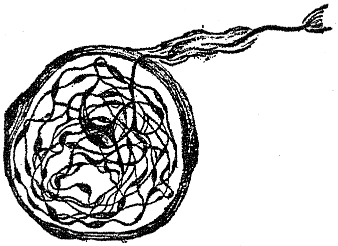

Fig. 132.—End-bulb of Krause from conjunctiva of man; methylene blue stain. (Dogiel, Arch. f. mik. Anat., vol. xxxvii.)

longed and detailed study. Some general concepts may however be given briefly.

The *first level reaction* is a simple type of integration in which there is a stimulus and a response of the reflex act type. An example is a cough, sneeze, an unexpected needle prick, etc. (Fig. 130).

The *second level reaction* is an integration involving more than one center. If a person accidentally touches a hot stove, the hand is withdrawn reflexly, but at the same time, one may cry, "ouch!" A level in the brain has become involved (Fig. 133).

The *third level reaction* is an integration involving thinking. It is illustrated by what may happen after the burn referred to above. The person may now consider what to

do about it. Shall the hand be bandaged? Should a doctor be called? What the individual does is a product of thinking and what he decides is the product of his information about burns, his attitude about his own injuries, and his judgment of the extent of the injury (Fig. 134).

The integration that takes place in this third level of reaction is dependent very little upon knowledge of the structure of the brain where integration occurs, but upon the kind of brain tissue the individual possesses and the learnings

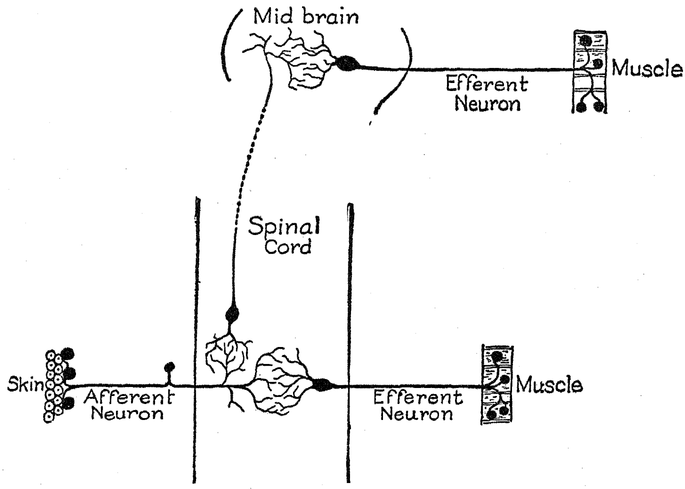

Fig. 133.—Mechanism involved in reaction of the second level added to that involved in first level. (After Gates.)

that it has acquired. The kind of brain tissue reveals the inborn qualities of desire, urge, or drive; the acquired learnings constitute the experiences of all kinds that the individual has had. The bearing of these matters upon mental hygiene will be immediately apparent.

The Autonomic Nervous System.—In addition to the structures of the central nervous system, there are an elaborate and much older series of nerve units consolidated into a chain of centers that lie outside the cord and masses of nerve centers around various organs. This comprises the auto-

nomic nervous system (Fig. 135). These nerve units carry on the living processes of the organism and for this reason were called at one time, the vegetative system. Their functions operate without conscious direction and normally take place without one being aware of them. In health,

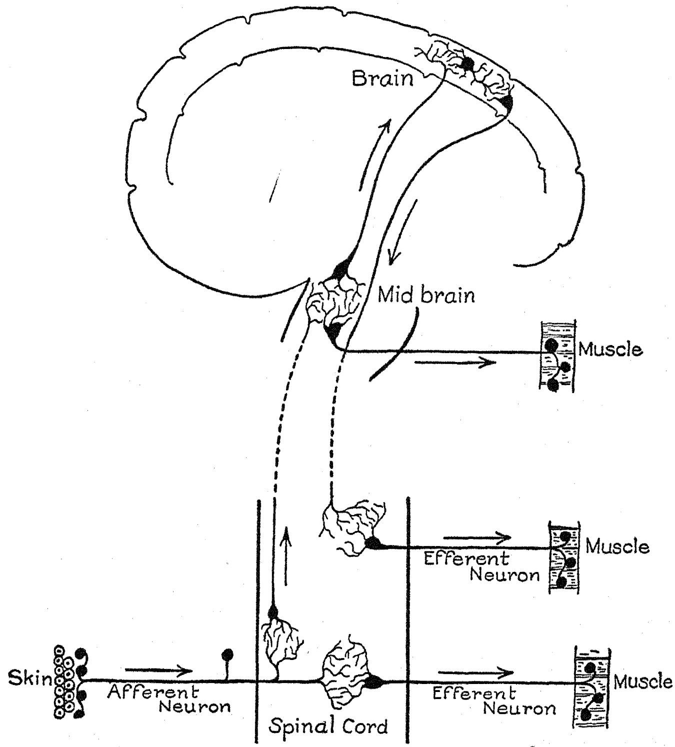

Fig. 134.—Mechanism involved in reaction of third level added to that involved in first and second levels. (After Gates.)

the heart beat, the secretion of bile, the growth of hair, the secretion of urine, and numerous other functions occur without any awareness by the individual. How these functions proceed, however, is constantly reported by the nerve cells of the system to their centers.

Summary of Functions of the Nervous System.—The ner-

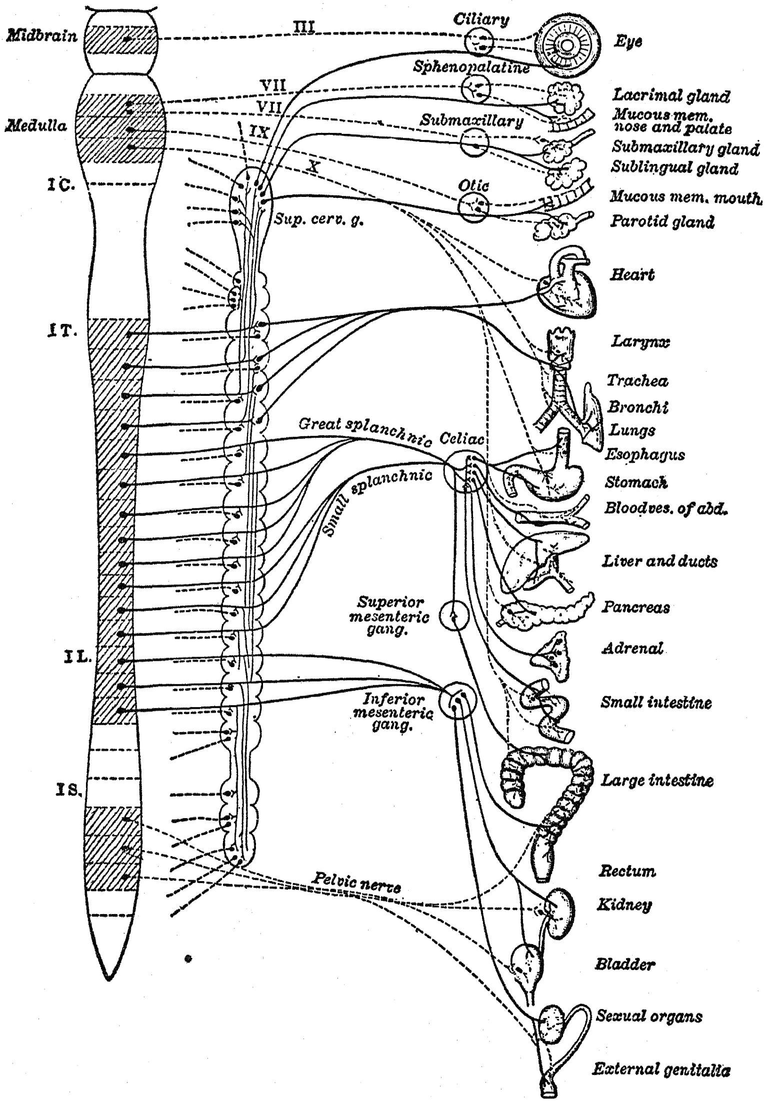

Fig. 135.—Diagram showing the autonomic nervous system with the sympathetic portion indicated. Today the term "autonomic" is used to include the cerebral part, the sympathetic (thoracicolumbar), and sacral divisions. (Modified from Meyer and Gottlieb.)

vous system, then, is an organization of stimulus-receiving and stimulus-sending elements. In simple one-celled organisms a stimulus is carried to all parts of the cell without the use of a special mechanism. In the human body, however, there is a highly-developed system of conducting nerves and coordinating nerve centers. In fact, there are two closely allied systems, the cerebrospinal and the autonomic, engaged in relating the individual to his environment. The former is concerned with voluntary movements; the latter with the involuntary movements and actions—types of activity associated with the involuntary muscles and the secretory glands. There is another interesting and important characteristic difference in the two systems; the cerebrospinal is concerned with the receptive, cognitive, and *will* aspects of life, phases represented by the large sense experiences that occur, by the understanding and interpreting of stimuli, and by the planning and purposing that precede the ultimate desired goal of the voluntary act, always an act of will; the autonomic, on the other hand, is concerned almost entirely with controlling the processes that maintain automatically the life of the individual. Some of these (autonomic) processes are protective, some deal with the transformation of energy, others with certain emptying mechanisms—all, however, are associated with the action of involuntary muscle in blood vessel, heart, intestine, or other organ and with secretory cells.

The cerebrospinal nervous system may be said to consist of brain, spinal cord, and nerves that lead to and from both brain and cord. The nerves coming to and from the brain are associated almost entirely with functions located in the head, such as sight, hearing, the use of the tongue, the sense of smell, and so forth, and are called cranial nerves. The nerves coming to and from the cord are associated with the skin and muscles of the body, and are called spinal nerves. It is to be noted that the phrase *to and from* is used. This use relates to function and not to structure. Thus it is that certain nerves carry incoming currents or stimuli and are known as *afferent nerves;* others carry outgoing currents or stimuli and are known as *efferent nerves.*

The afferent nerves carry to the brain either directly or by way of the cord stimulations from the skin, muscles, or other distal parts; the brain receives this stimulation, reacts in accordance with its character, and then sends out an impulse over the efferent nerves. No act may be considered completed until the entire circuit is made and the stimulus received has been responded to.[1]

The stimulations or impulses that pass over the afferent and efferent nerves travel over units in the nerve structure that consist essentially of a cell body with a number of branching processes. The message does not travel over a route like a telephone message, but at a number of places the route is broken and the message must transfer from one unit of the system to another. At many of these breaks in the course of afferent or efferent mechanisms a choice of routes presents itself. Which unit shall be chosen to carry the message? Now all that we do in education or in training of self relates to the selection of routes, to the formation of pathways in the brain and cord. Many connections are made that are not serviceable—they are discarded. The successful ones persist and habit forms to bind finally in firm bonds the individual, limiting and defining the range of activity for all time. Habits may be changed when they are "young"; on the other hand, it is often impossible to change habits that have been formed for years. There are exceptions, though, and by the force of a great emotion, or strong impelling ideals, the individual may with constant care entirely change the extent and character of his habits.

The autonomic system is associated with the digestive, nutritive, excretory, and secretory functions of the body.[2] Structurally it consists of groups of nerve tissue bound together into the chains that lie in front of the vertebral column (Fig. 135). By means of nerve branches they connect with other masses of nerve tissue, plexuses situated in the neighborhood of different organs.

[1] The response may be inhibition of visible activity.

[2] Timme, W.: The Autonomic Reciprocal Activities of Brain and Viscera, *Journal American Medical Association*, January 23, 1915.

These two systems, the cerebrospinal and autonomic, are closely associated in activity. In fact, the health of the individual is dependent upon the maintenance of a proper balance of activity between the two and a certain coordination and harmonious action.

Factors of Importance in Maintaining the Health of the Nervous System.—Some parts of the human body are older than others in the sense that they have undergone less modification in the process of evolution. Other structures may be considered as quite new. Thus the nervous system with its elaborate modification of the brain of man represents comparatively a recent achievement in organic evolution. Nevertheless, the nervous system embodies the whole story of human development, and, because of this fact, it exhibits in many of its reactions the primitive responses of the race.

The autonomic system is associated with the functions concerned in the maintenance of life. It is also connected with the whole emotional life. Cannon[1] has very clearly written of this relation of the emotions and has stated with scientific accuracy the fortifying mechanisms that are brought into play by the action of this system. Probably all cerebrospinal activity involves some excitation of the autonomic system. The two systems are so closely related that for many purposes of psychology they are considered as one. For interpretation of health values it is important to indicate some of the essential factors that are to be considered by those who are seeking to live at the optimum point.

Harmony of Action between Cerebrospinal and Autonomic Systems.—The health of the nervous system and, indeed, of the body as a whole, depends upon a nice adjustment of the work to be done by the two systems. Overuse of either one or improper use produces characteristic results.

A marked tendency in organic evolution has been the elaboration of the cerebral hemispheres. The effort has been directed toward central development. The necessities in education and in economic life have made the cerebrospinal

[1] Cannon, W. B.: Bodily Changes in Pain, Hunger, Fear, and Rage, D. Appleton & Co., New York, 1915.

a superior instrument for securing satisfactions in life. The autonomic nervous system, of supreme importance to the Pleistocene man, is today in a secondary position as regards social uses, needs, and duties.

This tendency has led unquestionably to a glorification of the cerebrospinal, so that in education, in business generally, in industry there has been little appreciation of the place and the importance of the autonomic nervous system in the life of man. It has produced the scholar who fails to understand the physical basis of life; it has evolved the scholastic system that omits from the educational curriculum the play life of the child. Historically, this tendency has given us, as Hetherington suggests, asceticism with its degradation of the body, scholasticism with its contempt of the physical, and Puritanism with its hatred and fear of play, self-expression, and drama.

Fortunately for man there is a growing appreciation of the importance of the autonomic system as a groundwork and foundation for the cerebrospinal. The great increase in nervous diseases, in nervous breakdowns, points the way to a new emphasis. The basis of life must be made secure. The whole tendency of civilization, with the tremendous growth of industrialism and the factory system, with the exaltation of "system" and "efficiency" as guides in production, is to cut straight across the essential biological needs of man, the organism. The neurasthenic, the "shell shocked," the nervous woman, the irritable man are persons who have taken on cerebrospinal activities beyond their capacity for accomplishment.

They need relief from the demands of the environment. As Weir Mitchell taught, "They need rest."

Fundamentally, the cause of this maladjustment is twofold. One factor is an inheritance of nerve tissue of poor quality. The fact that some individuals break, and that others do not, is a familiar one. The other factor is the philosophy of the century. To get ahead, to succeed, to become a captain of industry, to achieve the maximum production of wealth—these guides lead to nervous breakdowns and moral disasters.

The superiority of life on the cerebrospinal plane to life on the autonomic level is unquestioned. We can never justify a mode of living with health as the end of life. To develop the cerebrospinal system to its maximum points is the only acceptable ideal, but its foundation must never be forgotten. Socrates or Newton, Gladstone or Roosevelt, the common man himself, garbed though he be in his own heart as a modern Galahad in search of the Grail, will always need a generous participation in play, recreation, and physical work sufficient to keep the physical organism fit and ready to serve the cerebrospinal system to its best development. One who seeks to live most and to serve best will be guided very largely by this balance of systems. The great ideals of achievement and of service should rarely mean slow suicide; he only is fit to serve who keeps himself at his best.

Relation of Training to the Health of the Nervous System.—It is recognized that one may inherit a defective nervous system just as well as a defect of the skin, skeleton, or musculature. Nature passes on to the offspring the kind of characters the parents possess. This fact is immutable. Unfortunately, recognition of it serves as an explanatory excuse for much undesirable and unhealthful nervous response that is due to improper training. Not infrequently bad disposition, moods, temper, or irritability in the child are explained or excused, as the case may be, by the presence of similar traits in the parent. This explanation is based upon a belief in the hereditary transmission of the characteristic concerned. It is important, therefore, to evaluate the evidence in the matter and to determine the significance of training in the development of a harmonious well-balanced nervous system.

Bergson states one view of the problem: "Each of us, glancing back over his history, will find that his child-personality, though indivisible, united in itself divers persons which could remain blended just because they were in their nascent state: this indecision, so charged with promise, is one of the greatest charms of childhood. But these interwoven personalities become incompatible in course of growth,

and, as each of us can live but one life, a choice must perforce be made. We choose in reality without ceasing; without ceasing, also, we abandon many things. The route we pursue in time is strewn with the remains of all that we began to be, of all that we might have been."

This states the problem as regards the nervous system and such matters as "nervousness," "fears," "moods," attitudes, bad tempers, etc. The child who fears probably expresses this instinct of fear because the parent was afraid also in the presence of the child.[1] There is considerable evidence that there are two basic fears; the fear of loud noises and the fear of falling from high places. Intelligent response by the parent would in many cases, however, prevent an instinctive response by the child. The bad disposition in the child means usually bad disposition in the home. That is, we are dealing here with the effects of training; we are not dealing with biological characters that are immutable.

It should be remembered, also, that bodily states often determine mental and emotional reactions. James says, "Our moods and resolutions are more determined by the condition of our circulation than by our logical grounds." This has its bearing and should receive consideration. It is quite in harmony with James' theory of the emotions. But, indeed, the identity of bodily states and emotions, both as responses to a situation, renders another aspect important. Mental and emotional states are so closely associated with the physical expression of them that even the posture has influence on the way one thinks and how one feels. One with a depressing mood may speak hopefully and act happy; and presently the emotion of joy will come. Thus for health and happiness it may be essential to cultivate the power to replace moods, to rise above the depression of the moment by act of will.

It is well known that emotional upset may give rise to gastric, circulatory, or nervous disturbances. Experimental

[1] There is not complete agreement on this point. See Thorndike, E. L.: Educational Psychology, Vol. I, pp. 57–68, Teachers College, 1919.

evidence shows that rage, fright, and anxiety abolish movements of the stomach.[1]

The interrelations between central nervous system and autonomic system are well illustrated by the phenomenon of referred pain. Pain impulses are interpreted by the brain as coming from the area supplied by sensory nerves (Fig. 136) Pain impulses from viscera, not due to distention or contraction, are felt in the body areas overlying the part,

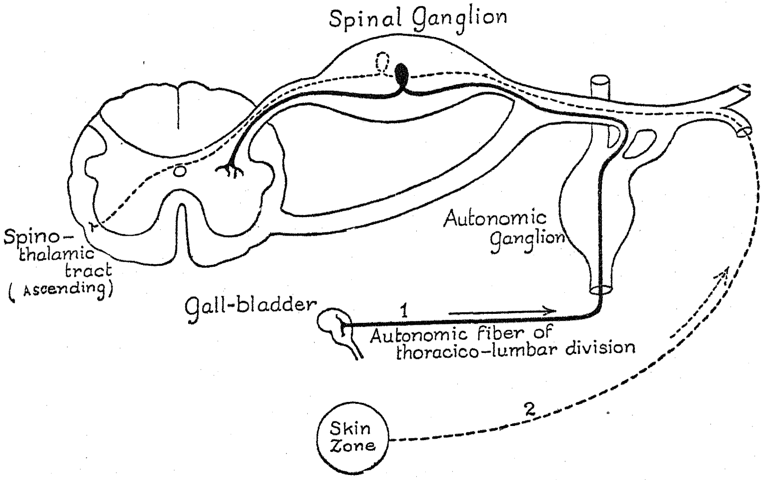

Fig. 136.—Pain impulse from gallbladder travels over autonomic fiber (1) to cord. Brain interprets impulses at this segment as coming from afferent nerve cerebrospinal system (2), and hence refers pain to skin zone supplied by 2. Synaptic connection between 1 and 2 may exist, but its location is not known.

and not in the part itself. The general explanation is that pain impulses reaching any segment of the cord goes up to the brain, and are interpreted as entering at that particular level at which sensory impulses would come in and hence they are referred to the sensory areas themselves (Fig. 137).

The significance of this reference to pain areas arises out of the fact that emotional disturbances acting through the autonomic system may give rise to sensations and even pain

[1] *Journal American Medical Association,* February 27, 1925, p. 748.

that is referred to visceral organs. These disturbances are very real to the person who experiences them, but they are functional in character and represent conflicts in the emotional life rather than disease in the organs indicated.

Attitudes Affect Functions.—The health and happiness of the individual are intimately bound up with the sort of habits and attitudes he develops and holds. Education should give all an equal opportunity to form proper habits

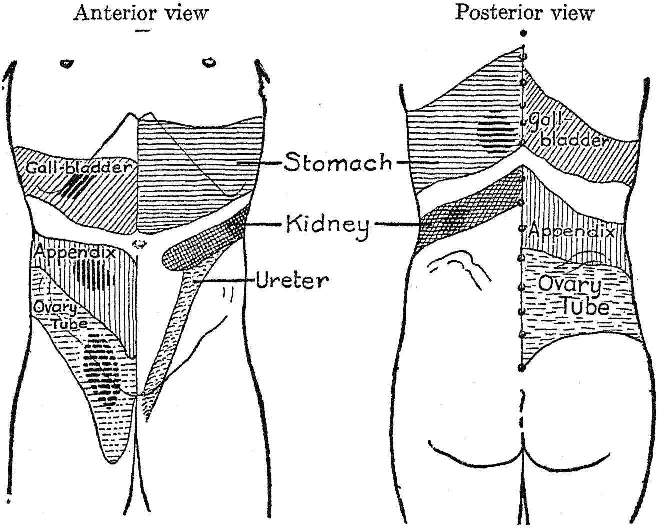

Fig. 137.—Location and outline of areas of increased sensitiveness and, in shaded areas, pain points for some of the abdominal viscera. (After Elsberg and Neuhof.)

and to develop wholesome attitudes. This does not mean uniformity in education, nor will it lead to a level of mediocrity. There will always be the superior ones who achieve, and inferior ones who accomplish little. Both groups may be healthy and happy if proper habits and attitudes are developed. It is important not to feed boys and girls mentally with such fallacies as "All men are created equal." Such an attitude leads directly to social unrest, social

inefficiency, social unhappiness. One person is not the equal of another by birth, nor can equality be conferred. Each person is just as "good" as he makes himself, limited, of course, by heredity and environment.

The business of government is to supply equality of opportunity for all before the law, for service and for education. The business of education, as Professor Briggs suggests, is to teach the individual to do better the things he will probably do anyway, and to help him to desire better things to do.

This means definitely as regards one's nervous system that one should not try to do work beyond his ability. An individual with C grade intelligence in a position requiring B grade intelligence is a failure. Socially he is inefficient; individually he is unhappy, and with reference to his nervous system extremely unhealthy.

To gain wholesome attitudes concerning home relationships and worthy use of leisure, to hold vocation and avocation in proper relationship, to develop desirable social and moral qualities, breadth of view, scientific appreciations, are the foundations of health of the nervous system. Skill, honesty, diligence, spirit of sportsmanship, courage, self-control, faithfulness, loyalty to high ideals, interest in and love for play—these are the result of training,[1] not of birth.

Within certain limits anyone may determine the kind of nervous system he will have. He may control worry by steadfastly refusing to worry over little things; he may avoid fears by early abstinence from all indulgence of fear; he may surmount an irascible temper, moody disposition, or introspective manner by constantly seeking early and at all times for controlled expression, cheerfulness in life, and the needs of others.

The Significance of Defective Inheritance in the Nervous System.—The most favorable training will not compensate for defects in nerve structure. Numerous examples can be given by clinicians of types surviving the stress and strain of life's problems in a favorable environment, that break

[1] See Atlantic Monthly, July, 1921, an article by Theodore Knappen on the Morain Park School, Dayton, Ohio.

completely when subjected to unusual and too severe demands. Many miscalled "shell shock" cases of the World War testify to this fact. It must be recognized that many expressions of bad temper and bad disposition, as well as bad politics, bad economics, and bad sociology are due to defective innervation that cannot in the present organization of society be prevented easily. Numerous instances of this state of affairs occurred during the preparedness campaign in America before the war and continued even during its progress.

It is not always easy to see the larger goals beyond the immediate, insistent difficulties that must be met. This attitude is similar to the one held by numerous persons to whom the operating room of a hospital is a place of horrors where hideous things are done to living bodies with sharp knives. They even regard the surgeon as a monster of callousness because he can do such work without repulsion.

The normal mental attitude toward difficult affairs of life sees through the dangers, the strains, and the uncertainties to the distant goal, the desired end. Thus, one would not view operations as ends in themselves, but only imperfect means to other ends more worth while than the conditions which provoke the operation. Until humanity has evolved among men better procedures than those represented by the gun and the knife, injustice, slavery, and cancer must be met with the tools that are serviceable. The normal life will be prepared to meet crises. When the crises come, and the stresses and strains weigh heavily, then habits of clear thought, attitudes of social responsibility, of honesty in facing problems, and of meeting them squarely, will be sane guides and counsellors.

Motives in Life.—People have wants; they desire certain outcomes. The manifestation of these wants are the motives that appear, either openly and expressed, or hidden and even denied. In simple living conditions the wants are simple and the motives direct. The man is hungry; he goes in pursuit of game. He is cold; he builds a fire or seeks shelter. He is alone; he seeks a companion.

In civilized life, there has accumulated over the centuries

a great variety of customs, taboos, and traditions that are amazingly powerful. Simple motives are now crossed by other motives and simple wants hindered by desire to satisfy rules or regulations. Hence arises a conflict between what the individual as an organism wants and what society as a living group of people want. The conflict is not always present, but with many persons it is a constant factor.

In recent years, this whole matter has been elaborately described and developed with a most pretentious terminology. The self-centered individual, taking pleasure only in self is supposed to show narcissism. An older generation had a simple phrase for it—"stuck on himself." In similar fashion, the boy who grows into older years overly dependent upon his mother is, in the new jargon, manifesting the Oedipus complex, but the older phrase, "tied to mother's apron strings," is more descriptive.

The fact is, of course, that the elaborate development of theory regarding the self, the unconscious, and the subconscious, the id, and the super-ego has made not for clarity but for confusion.

Life is very simple, and the organism seeking to satisfy its wants comes into conflict with others, with customs, and with standards of living that the individual has learned and desires to follow.

The Normal Mental Life.—The normal mental life flows from states of satisfyingness. The healthy state of mind is satisfaction with life. Mental activity that is hurried, driven, anxious, or depressed, that is charged with "long-range apprehensions," fears, worries, is distinctly injurious to health both of mind and of body.

Now the healthful mental state can be developed just as surely as big muscles can be. The process is neither so simple nor so easy, but it is not too much to say that most persons can so direct their thoughts and so order their lives as to attain, gradually, a higher level of control than either their heredity or training would have promised.

Mental training means a training in control, in removal of unwholesome states, and in substitution constantly of wholesome plans, purposes, and satisfying interests.

Worry.—The most common form of abnormal mental functioning is called worry. It represents a situation that has been created by civilization with its many "long-range apprehensions," fears, and outcomes. It requires the direct cultivation and development of mental quality that will offset, neutralize, and render harmless the tendency to worry. We cannot put man back to the state of the lower animals where only immediate danger provides a stimulus. The food supply next month is of no concern to a cow or a camel, it is to man; the length of tail or glossiness of fur amounts to nothing at all in the immediate jealousies and quarrels of the fox, appearance does in man; the wildness in a young colt does not cause the sire or dam to lose sleep, it does in man.

With man, then, the elaboration of the cerebrospinal nervous system has brought into the field of mental activity fears and anxieties that cannot be met at once; they have "long-range" quality.

Now to such situations there must be presented a philosophy of life, a point of view, a characteristic reaction that will enable the individual to meet the problem, whatever it may be.

It must be clear at the outset that a wholesome mental attitude cannot suddenly be acquired. It can never be a gift; it is always won. It comes by persistent and conscientious effort to see straight, to keep the values of life clear.

Worry may be better understood by analyzing it in the common groups in which it most often occurs. They are: what we have done, what we are going to do, what people think of us, and our health, mental and physical.

Worry Over What We Have Done.—Worry over some work that was done badly or some act that should have been omitted is a very common form of worry. It is tied up with the third form of worry, the opinion of others, because we see the social judgment upon the act or work more than our own cognizance of its impropriety or inferiority. Now one can lessen worry about what one has done only by reflecting briefly, "What is done, is done." The mistake should be a lesson and not a subject for regrets and recrim-

inations. The experience may be made a stepping stone; worry over it makes it a stumbling block.

One of the great public school masters of England, Edward Bowen of Harrow, constantly said to his boys: "Take the sweet and bitter as the sweet and bitter come, and always play the game." This is the legend to be written under the true sportsman. Playing the game in life situations is just another way of "living most and serving best."

The present and coming generations will have increasing need of a philosophic faith that will lead from mistakes and failures to calm, clear resolution rather than to incoherent, aimless wanderings of the mind. This generation shows its need for help along this line. The faith of our fathers is not strong today. "The Everlasting Arms" do not appear to be "underneath" bearing up the sojourner in life's whirlpools or recesses. The constant invention of new religions indicates the demand. There is a turning to the Higher Thought, to New Thought, to Psychotherapeutics, to Occultism, to Spiritualism—even to Epicureanism (let us eat and drink, for tomorrow we shall die). These may be effective for simple minds in need of formulae; the intelligent soul will face the mistake, the act and its consequences, and will say, "It's done, but because it's ignoble or because it's muddled, or because its unwholesome, it shall not be done again." No need for metaphysics here. Break your best china—then think of a lovely rose? No. Such formulae are only for those weak spirits who would never be interested in achieving intelligent control in life anyway.

The psychologist is helpful with this type of worry. He tells us that the mind is so constituted that a morbid memory cannot be driven out by repeating, "I will forget it." *One thought can only be driven out by another.* The stream of consciousness is a stream and is always flowing. Selection of a proper subject for mental examination or engaging in work of an interesting kind will replace the undesirable worry with an acceptable activity. This choice must be conscious, intelligent, and directed.

This form of worry is seen in its simple manifestations among those who get up to unlock the door to make sure

they locked it. Better is it for one to allow a burglar to carry the entire house away than to subject one's nervous system to such activity.

It is important to give thought to the morrow, but one should practice doing carefully what one has to do and then dismissing the matter from the mind. The danger of losing mental health must be set over against the cost of leaving the gas burning in the hall, or the door unlocked, or the possible errors in the final examination.

Worry Over What We Are Going to Do.—Worry about a task that is to be done is destructive of the power to do the task well. Here again substitution is important. One should substitute work on the task for the useless fear—whether one has sufficient ability for the task or not. To size up the work, to decide to do it, and then to start is the beginning of successful accomplishment. One should avoid spending too much time deciding what to do. A proper amount of attention should be given to consideration of the thing to be done, and then—one should pounce upon it. A mistake may be made; others make mistakes. Important questions have been and probably often will be decided wrong.

The young person who worries about success prevents himself from succeeding. The whirling, interesting present moment is the treasure to grasp. The yesterday with its failures, the morrow with its unknown, are to be passed by. Life is here and now. One who exists now only to live at some future time misses the great opportunity. The training one puts oneself through is life, not a preparation for life. This very moment will never come again. Even now it is gone. The hand that writes, the eye that sees this line cannot bring it back. Here and now is life—fill it full of "work, of play, of love, of worship."[1] The summum bonum is Happiness.[2] Not the base kind that smacks of

[1] Cabot, R.: What Men Live By, Houghton Mifflin Co., Boston, 1914.

[2] Henri Poincaré starts one of his recent books with the remark that the chief aim of man is to search for truth. Truth and happiness are very much akin when truth in concrete forms is directed in the service of man and happiness remains truthful, free from sham, and the similitudes of mere smiles.

race tracks, wine, music halls, and commercialized vice. But rather the kind that Saleeby speaks of,[1] "There is no human end but happiness, high or low. Its one absolute negation is neither poverty nor ill-health, nor material failure, nor yet starvation—'he that is of a merry heart hath a continual feast.' The one absolute negation of happiness is worry or discontent. A prosperous society consisting of strenuous worried business men who have no time to play with their children, or listen to great music, or gaze upon the noble face of the sky, or commune with the soul . . . of which another poet, Wordsworth, said that it was 'like a star that dwelt apart'—such a society may be as efficient as a bee-hive, as large as London and as wealthy, but it stultifies its own ends, and would be better not at all. 'Better a handful with quietness than both the hands full with travail and vexation of spirit.' " We might well say of happiness as Emerson said of the beautiful, "Though we travel the world over to find the beautiful, we must carry it with us, or we find it not."

Worry over what we are to do may take various forms. At times it will be directed at vocations; at other times it is greatly exercised over the problem of marriage. These are important problems. They are not to be solved out of hand, nor do they admit of continual analysis. To find one's best work where the tasks will have meaning and the compensations are paid in happiness and joy is not easy. But worry over the outcome of a vocation prevents any careful study of the vocation, its special requirements, its fields of opportunity and responsibility. The choice of a life mate causes less worry as a rule than the choice of a vocation because the former is so often an emotional act rather than an intellectual judgment. The worry comes more often *after* the choice has been made. More intelligence and less emotion before and less analysis and more love after marriage would probably decrease if not entirely eliminate worry in this field.

Worry Over the Opinions of Others.—A friend of mine keeps

[1] Saleeby, C. W.: Worry, Frederick A. Stokes Co., New York, 1907, p. 22.

on his desk a card index of data that he is constantly using. Under the section C he has a card headed "Criticisms." There he has written from time to time criticisms of his work, his manner, his personality. Some have been very helpful; others have been silly—in his judgment. The only intelligent response to others' opinions is to be thankful for the criticism. If it is good, use it; if it is silly, throw it into the waste basket.

The danger to mental health of being sensitive to criticism cannot be overstated. Most persons do not appreciate the mental damage that comes from nursing a slight or mulling over in the mind a fancied wrong. One should avoid moods and poutings as one would the plague.

If someone has spoken unjustly, unfairly, one should classify the criticism as foolish and the critic as unreasonable and *forget it.* If the criticism is a just one, one should swallow one's pride, bow the knee, and *learn.* It is not a question of courage, it is a question of perspective. As Theodore Roosevelt[1] would say, "It is a question of the major interest driving out the minor interest."

Women need to be particularly alive to this matter of criticism. All sensitive natures must cultivate the unheroic and commonplace. One cannot with any safety indulge in the melancholy pleasure of playing the martyr. I know a woman who always seeks out difficult and burdensome tasks, so she can say afterward, "Oh, how hard it was! No one knows how I have suffered." For such there is no mental poise, no happiness at all until the relation of self to the world has been adjusted.

Worry Over Health.—It is important to form the habit of taking the health of mind and body for what it is and making the best of it. True, if the condition can be improved, the most careful and scientific care should be used to restore it entirely. But useless fear and worry not only prevent the development of the best health, but, indeed, produce disturbances that are quite distressing.

Whenever the activity of the cerebrospinal system flows

[1] Robinson, C. R.: My Brother, Theodore Roosevelt, Chas. Scribner's Sons, New York, 1921, p. 274.

over into the realm of autonomic control a precious balance and harmony are disturbed. The nutritive processes of life are designed to go on without conscious direction. The beating of the heart, breathing, digestion, peristalsis, liver activity, excretion, and other functional activities are controlled by the autonomic system and spinal cord. The higher centers should at no time be conscious of them or concerned about them. Saleeby[1] says, "Those bodily processes and functions which are under the control of the lower levels of the nervous system are best performed when those lower levels are left undisturbed by orders from above. This is true not only of such functions as sleep and digestion but also of other functions which, at one time in the history of the individual, have required the most direct and painstaking efforts of conscious attention."

Functional diseases of the nervous system are frequently caused by worry. Both hysteria and neurasthenia result from worry. The following question and answer from Dr. Evans' column in the Chicago Tribune[2] illustrate a case of neurasthenia and suggest in the last sentence of the reply the reason for the development of religious healing.

MENTAL HELP IS NEEDED

Hopeless writes: I have doctored ever since I was five years old. At that time I had typhoid fever and pneumonia. It left me with nervous trouble and which I have tried hard to overcome. I cannot go any place because I get nervous. It seems to work on the stomach. There is a beating and I always feel as if I have to vomit. Do you think exercise will help, such as swimming and tennis?

REPLY

Taking medicine will do you no good. You are a neurasthenic and you suffer from anxieties and fears. You can be cured, but it will take time. It is a matter of mental and social training. If you get in the line of such training and have the patience and perseverance to stick, you can win. There are bushels of religions, philosophies, cults, and such suited to just your kind of people.

The emotional person will often require a symbol, creed, or formula by which to guide life; the person with matured intelligence, with rational guides, will not require such

[1] Saleeby, C. W.: *Loc. cit.*, p. 33.
[2] Chicago Tribune, August 23, 1921.

expedients, but will, by volitional power, force himself to think properly, to control emotions, and to banish fears. The neurotic person who is unable to or does not desire to heal himself should in every instance engage the services of a scientific physician who commands the respect of the patient by the power of his personality.[1] Psychologists recognize this power and call it suggestion. The skilful physician uses suggestion in functional disturbances. Such a procedure for the neurotic will secure the service that a magic cult would give and, in addition, it would provide that medical care which will be needed in the advent of a real organic disease.

Worry over one's health leads inevitably to increased disturbance of body functions. Hysteria, neurasthenia, hypochondria, with its many fears, are matters of gradual growth. They are not suddenly developed out of hand.

One who allows oneself to worry about small matters, who expects heart disease or deafness from every sore throat, is laying a foundation in abnormal mental reactions for unhappiness and ill health.

Development of Wholesome Mental Habits.—It is quite possible for many persons to develop wholesome mental responses and for many to achieve a higher type of control than the usual and customary. The secret lies in holding even, in unimportant situations, the unemotional, sane, intelligent attitude. Saleeby[2] says, "It is pre-eminent necessity for the irradiation amongst the people of that fine temper, half philosophic, half religious, half intellectual, half emotional, half rational acceptance, half faith—the faith of Socrates that to the good man no evil thing can happen—the temper that possessed the soul of Wordsworth, who, whilst others were distressed, disheartened, at the betrayal of a patriot, addressed him in these great words:

" 'There's not a breathing of the common wind
That will forget thee; thou has great allies;
Thy friends are exultations, agonies,
And love, and man's unconquerable mind.' "

[1] It would appear that Dr. Evans could have served Hopeless better if he had been in a position to recommend a physician.

[2] Saleeby, C. W.: *Loc. cit.*, p. 2.

To train oneself in small things to meet the problems of life is the beginning of that power which in the crises of life will find the owner strong, able, and sufficient. Such training should be begun in childhood.[1] Situations should be met by boys and girls without allowing them to expect the rescuing hand.[2]

A list of wholesome mental traits important for health will not satisfy everyone, perhaps, but the following appear significant: confidence, faith in the goodness of life, open-mindedness, and unselfishness.

Confidence.—Confidence in self, in one's power, in the intrinsic value and worthwhileness of one's own personality is essential for the most abundant life. It was the principle that Jesus taught in His insistence upon the love of the Father for each person. This belief in one's power and one's worth lies at the foundation of all worthwhile work and accomplishment.

Experimentally, its value has been determined. Give a subject a puzzle, and if he says, "I don't suppose I can do it," he renders his mind less able to discover the means for its solution. He may even insist that it cannot be done. If inadvertently he solves the puzzle, but has not learned the process, he will attack it with more confidence. The experience of success increases his confidence.

This fact has significance for education. It suggests one reason for the large number of persons who lack grit, courage, confidence. It corroborates the views of Goddard[3] with respect to the necessity for vocational training and adjustment.

The only sure way to develop confidence is to try honestly, and to keep at it until the experience of success comes. Reasonable intelligence would prevent selection of work for which one was wholly unsuited, and from which no success to mention could be expected.

[1] Paton, S.: Human Behavior, Chas. Scribner's Sons, New York, 1921, pp. 394–454.

[2] Williams, J. F.: Values of Camping for Girls, *Teachers College Record*, January, 1920.

[3] Goddard, H. H.: Human Efficiency and Levels of Intelligence, Princeton University Press, 1920.

The opposite of the attitude of confidence is fear. It is held by some psychologists that only two fears are inborn and all others, except fear of falling and fear of loud sounds, are trained into us. Fear twists and warps personality and even produces disturbance in body functions. Fear is a prominent cause in stammering.

Faith in the Goodness of Life.—Faith in the goodness of life, here and now, will be based upon an understanding of man's relation to man and to God. It will not consider this world an evil from which an escape is Nirvana to the soul. Rather it will hold the pulsing moment to be real life in which all that one most desires is enshrined. The devastating war, the serious disease, the broken promise, the unrequited love, are but incidents to the man with faith in the goodness of life, whose course is chartered not by individual suffering, shame, or joy, but by the progress of the race.

What happens to the individual is important, but what happens to the race of man is supreme. Viewing that, one should see with Tennyson—

> "That nothing walks with aimless feet,
> That not one life shall be destroyed
> Or cast as rubbish to the void
> Till God hath made the pile complete."

and with Browning when he sings,

> "God's in His Heaven,
> All's right with the world."

The path to faith in the goodness of life lies among the commonplace everyday affairs of work and play. The exotic, the bizarre, sensational course must be avoided. The simple life, as Pastor Wagner[1] taught, makes for such faith.

Faith in the goodness of life means optimism. It is not the optimism of the sentimental Pollyana who says that all things are beautiful. Values need not be mixed in that way. All things are not beautiful. Many things are rotten,

[1] Wagner, Charles: The Simple Life, McClure, Phillips & Co., New York, 1902.

ugly, and totally to be condemned. Optimism means joy in the wonderful things of life, of which there are many.

Nothing is quite so destructive of real happiness and health of mind as pessimism. Doubt, fear, and self-consciousness are the plague demons of joy. On the contrary, play, laughter, lack of a dull seriousness are the tonic needed by the jaded nerves of civilized man. Those who can play (and play is a psychologic attitude) live—they burn; others only smoulder.

Bangs' poem of a happy child strikes the note for this faith that is the testimony of poets and the scientific record of physicians:

"I do not sorrow when there's snow
Or rain, or fog, or sleet,
There are more toys at home, you know,
Than out there on the street.

"So whether we have bright sunshine,
Or clouds all through the day,
I never sorrow or repine,
But play, and play, and play."

Open-mindedness.—Open-mindedness and breadth of view make for sanity. The restricted vision, the institutionalized mind, continually clashes with the growing liberalism in the world. It will increasingly clash because asceticism, scholasticism, and Puritanism are meeting everywhere the opposition of minds freed from the traditional. To keep an open mind means to be willing to accept any new proposal, however at variance with established belief or custom, whenever the new presents facts to sustain its contention. The open mind will see the facts, will not close itself off from the facts. It prevents thereby the rigidity of mind so allied to the fixed idea of the insane. Open-mindedness means plasticity of mind, ability to see new relationships, to feel new meanings, to find new values. It makes for variety, interest, and health.

Unselfishness.—Finally, unselfishness as an attitude is to be cultivated because of its wholesome effect on health. It may be warranted on moral and social grounds, but aside from these justifications it lies at the very root of satis-

factions in life. Mental growth and mental health feed on satisfying situations. The permanent satisfactions in modern society come from unselfish service to the world. In a primitive society the original instincts for selfish ends would be more satisfying, but today the selfish person erects a splendid isolation around himself, that leaves him, because of the very gregariousness of man, an unhappy, disgruntled, and unwholesome soul.

There seem to be at the very foundation of all wholesome mental life—confidence and belief in self, faith in the goodness of the world, open-mindedness and breadth of view, and unselfishness. To others may appear other values. It is for all to choose. What roads we travel matters very little. That we arrive at our desired goal and that the goal shall be worthwhile—this is the test.

Insanity.—Insanity is a mental disease with such departures of mental functioning from the normal that the whole personality of the individual is changed. This change is usually gradual. Commonly it is looked upon as sudden, peculiar, and mysterious. Quite the contrary is the case. It is the logical result of changes occurring in the brain, its causes are, in the main, well known, and it comes as a gradual deterioration. Many of the insane in hospitals today might have retained their mental health if they had known the necessary facts and had acted in accordance with them.

In insanity there are two elements involved—the predisposing and the exciting. "The predisposing are the inherited and acquired abnormalities of the individual, while the exciting are to be found in the storms and stresses of life. Of these two the first must positively be present, but not always being evident, it is often overlooked, and it is the second or the exciting cause, itself relatively unimportant, that is held in popular belief, generally alone responsible. Thus we hear of persons 'going insane' from grief and from disappointment, from fear and from shock; but, while it is true that without something of these the disease might never have developed, it is equally true that none of them alone can bring it on. Storm and stress factors enter into

the development of practically all mental disorders, both mild and severe, but they are only *factors*, the ultimate causes lie deeper."[1]

Types of Insanity.—The types of insanity are fairly well defined. De Fursac[2] suggests a classification that is used as a basis for the simplification given below:

1. Psychoses based upon defective nervous tissue, called morbid predisposition or constitutional psychopathic condition. In this group are paranoia, manic-depressive insanity, obsessions, sexual perversions, and mental instability. Mental hygiene is most important in this group.
2. Psychoses based upon toxic or infectious processes. In the former are alcoholism, morphinomania, and cocainomania, and in the latter, infections such as typhoid, diphtheria, hydrophobia, influenza, and tuberculosis. Personal hygiene is very important in this group.
3. Psychoses based upon syphilitic infection, as seen in general paralysis (paresis) and locomotor ataxia. Personal and social hygiene are important in this group.
4. Psychoses based upon auto-intoxication (Kraepelin's view), such as dementia praecox. This condition occurs usually before the age of twenty-five and rarely after thirty. It follows a poisoning of the body, at times after a severe infection, as scarlet fever, or at other times, a disorder of the sex glands seems to be the factor, as indicated by its appearance at puberty or in the female at the first childbirth. Meyer believes that this type belongs more properly with the constitutional psychopathic group (Group 1 above).
5. Psychoses of involution, such as affective melancholia and senile dementia.

Causes of Insanity.—The causes[3] of insanity are known in the main. Omitting heredity, they may be considered under four headings:

Syphilis.—Paresis, often called general paralysis, and popularly known as "softening of the brain," accounts for about 20 per cent of the insane admitted to state hospitals. Syphilis as a factor may be considered even more important because of its relation to tabes dorsalis and the mental deterioration that comes in the late stages of this condition.

[1] Platt, C.: The Psychology of Thought and Feeling, Dodd, Mead & Co., New York, 1921, p. 233.

[2] De Fursac, J. R.: Manual of Psychiatry, John Wiley & Sons, New York, 1913.

[3] Paton, S.: Human Behavior, Charles Scribner's Sons, New York, 1921, p. 27.

Syphilis is a common infection; insanity, a relatively rare condition. The disease may be expended upon other organs than the brain, but when it attacks the brain some form of mental disturbance is bound to result.

In the main, syphilis is recognized as the cause of paresis. The disease at this stage is incurable by any means known to medical science. The brain tissue has been changed, and when once altered, it is thereafter impossible to restore it to normal.

This causative factor produces serious destruction to other organs of the body, namely, the heart, liver, blood vessels, and bones. It presents a problem not only to the individual but also to society that should challenge the most intelligent effort for diagnosis, isolation, and treatment.[1] Its frequent connection with immoral living and its certain moral and social censure of the infected individual are the factors that have prevented a rational administration by boards of health. In the light of all the unhappiness, ill health, and early deaths caused by the disease it is not too much to say that it should be treated according to the established principles of communicable disease control.

Alcohol and Other Poisons.—Another group of mental diseases are due directly to the habitual use of alcohol. Alcoholic insanity may be brought on by the regular use of alcohol even in "moderate" quantities not producing intoxication. The close relation between alcohol and insanity has only recently been fully realized. Statistics as to the number of cases in which alcohol is the direct cause necessarily vary in different localities. Fully 30 per cent of the men and 10 per cent of the women admitted to the State Hospitals are suffering from conditions due directly or indirectly to alcohol. So marked is the effect of alcohol upon the brain and the nerve tissue that it helps to bring about a number of mental breakdowns in addition to the alcoholic insanities.

[1] Bigelow, N. A.: Sex Education, American Social Hygiene Association, New York, 1936. The Problem of Sex Education in Schools, United States Public Health Service, Washington, 1919. Social Hygiene Education, Bulletin No. 13, Teacher's College, New York, 1921. The United States Interdepartmental Social Hygiene Board Activities, 1919–1921, Reprint Annual Report, June 30, 1921, Washington.

Alcohol is a poison. A long series of careful tests[1] performed by eminent authorities showed that even small quantities of alcohol may lower the mental capacity, and that it takes much longer than is usually supposed for this effect to wear off.

In this day of keen competition every man needs the highest possible development of his mental capacities. Not only is the highest mental development impossible with the continued use of alcohol, but impairment of the mental faculties is likely to follow.

Other poisons, such as opium, morphine, and cocaine which, with alcohol, are the principal parts of many patent remedies, often weaken the mental powers and produce insanity.

Physical Diseases.—Some mental breakdowns may be traced to the effects of other physical diseases. Typhoid fever, influenza, diphtheria, and some other diseases often so poison the system that for some time after the disease itself has left, the regular functions of the body are seriously interrupted. It is probable, also, that the poisons so produced interfere with the nervous system. Consequently, a mental breakdown is sometimes a delayed result of such diseases. Among other physical causes of insanity are tuberculosis and diseases of the arteries, heart, and kidneys. Aside from the direct physical effect of these diseases, they have a tendency to disturb the mind by discouragement. A person suffering from any such disease should have good nursing, skilled medical treatment, pleasant surroundings, and freedom from anxiety. Often these can be had only in a hospital. Prejudice against hospital care is largely unjustified.

Overwork is often spoken of as a cause of insanity. This is not correct.[2] Hard work alone rarely causes a nervous breakdown. It only becomes a menace to health when associated with worry and loss of sleep, or causes mentioned under other headings.

[1] Williams, J. F.: Healthful Living, The Macmillan Co., New York, 1919, pp. 407–413.

[2] Overwork associated with other conditions may result in an exhaustion psychosis.

The control of infectious diseases, protection of food and water supplies, temperance, and healthful homes and factories, all these help to prevent mental as well as physical diseases.

Mental Habits.—Aside from physical causes there are also mental causes. They are the most important causes of some forms of insanity. The healthy state of mind is one of satisfaction with life. This does not depend so much upon our surroundings, or how much money we have, or how many troubles come to us, as upon the way in which we train ourselves to deal with difficulties and troubles. Anyone who departs too far from this state of satisfaction must be regarded as tending toward an unhealthy condition. Of course, not all persons start with the same kind of mental make-up. Some, owing to heredity, unusual experiences, or bad training, have what is called a morbid disposition. But disposition is not something fixed like the color of our eyes. It must be looked upon as made up of many tendencies which often can be changed or modified by training and proper mental habits. *Health is a duty* which the individual owes to himself and to others. Mental health is as important as physical health. The average person little realizes the danger of brooding over slights, injuries, disappointments, or misfortunes, or of lack of frankness, or of an unnatural attitude toward his fellowmen, shown by unusual sensitiveness or marked suspicion. Yet all these unwholesome and painful trains of thought may, if persisted in and unrelieved by healthy interests and activities, tend toward insanity. Wholesome work relieved by periods of rest and simple pleasures, and an interest in the affairs of others, are important preventives of unwholesome ways of thinking.

There are over 250,000 patients in hospitals for mental disease. Each year 50,000 persons are admitted for the first time.[1] Over one eighth of the total expenditure in some states is for the insane. Whereas most hospitals for mental diseases are overcrowded, the average daily number of patients in general hospitals is about one half the number of available beds. This is another indication that people are

[1] *Nation's Health*, March, 1923, p. 184.

learning how to live with regard to the environment, but are not directing their lives in intelligent ways.

Alcohol and the Nervous System.—The alcohol problem was not settled by prohibition, nor has it been solved by repeal of the law. It will be settled only by education.

Alcohol presents a social problem that cannot be treated at this time. Evaluation of its relation to poverty, immorality, crime, and general unhappiness is a matter of social economy. What are the facts regarding the effects of alcohol upon the health of the user?

The chief effects are seen in the nervous system. Digestive tract and circulatory system show untoward changes from alcohol, but the nervous system is mainly attacked. Legrain[1] made a careful study of the effects of alcohol on the nervous system, and presented data that should be considered carefully by students of the problem.

On the contrary recent studies[2] of the influence of the World War on alcoholism in different countries in Middle Europe disclose a remarkable uniformity. There was a progressive decrease in delirium tremens, alcoholic psychosis, and other mental troubles due to alcohol observed in different institutes for psychiatry beginning with and continuing throughout the war. Later came a return to pre-war conditions to be followed by an increase of disturbances well beyond pre-war alcoholism. The so-called "benefits of prohibition" after 1917 parallel a decrease in Europe where there was no prohibition. The evidence is so contradictory on each side that he who wishes to make a case can find reports that support his position, whatever it may be.

The external effects of alcoholism show in the irritability, the increased susceptibility to disease, and the lowered vitality of those who use it. The internal effects are marked, and the early experiments of Professor Stockard[3] apparently

[1] A monograph on Alcoholism and Heredity, published in the *Annales médico-psychologiques*, December, 1921.

[2] Vogler, P.: Beitrag zur Alkoholstatistik in Tirol, 1904–1926. *Zeitschrift f. d. ges. Neurol. und Psychiat.*, **111**: 661, 1927.

[3] Stockard, C. R.: *Archives of Internal Medicine*, 1912, x, 369; *American Naturalist*, 1913, xlvii; *Proceedings of the Society of Experimental Biology and Medicine*, 1914, ix, 136.

show the influence of alcohol as a detrimental factor in inheritance. Recent work by Stockard[1] and by Pearl,[1] the former with guinea-pigs, the latter with fowls, shows alcohol to have a racially beneficial effect that is selective. These carefully controlled experiments show a higher mortality in the alcoholized animals, but those that do survive are the more vigorous individuals. In their main results, the work of Stockard and of Pearl has been corroborated by other scientists.

The scientific evidence is accumulating. Alcohol is not a food (it burns too fast for the human machine); in the individual it poisons the highest centers, and sets free the lowest instincts by removing the inhibitions and controls of the brain. Racially it has a selective action and eliminates the weak stock. The classical study of the effects of alcohol by Dodge and Benedict[2] deals mainly with the psychological data. A more recent work by Emerson[3] and associates presents an excellent survey of the literature, and offers a very well-balanced discussion of the alcohol problem.

The modern view of health that is sustained largely by an ideal of social responsibility rejects the fallacious argument for personal liberty. Oh, Liberty, how many crimes are committed in thy name! Liberty does not mean the right to do as one pleases, but rather an opportunity to develop to the highest and secure the greatest happiness in life *so long* as other members in society are not injured. This highest development of the individual must be attained under conditions that at all times show regard for others. If this regard is not shown, many social disturbances arise and at this point the proposals of the socially minded appear for handling the difficulties. There are those who would seek

[1] Stockard, C. R.: Alcohol as a selective agent in the improvement of racial stock. *British Medical Journal*, August 12, 1922, pp. 255–259. Pearl, R.: On the Effect of Continued Administration of Certain Poisons to the Domestic Fowl, with Special Reference to the Progeny. *Proceedings American Philosophical Society*, vol. LV, pp. 243–258, 1916.

[2] Dodge, R., and Benedict, F. G.: Psychological Effects of Alcohol, Carnegie Institute, Washington, D. C., 1915.

[3] Emerson, H.: Alcohol and Man, The Macmillan Co., New York, 1932.

by education to help the individual to acquire consciousness of social needs and to develop social motives as guides for action. On the other hand, there are those who would remove from the environment all disturbing elements so that the individual could offend no social standard. The former criticize this latter view and argue that the finest growth takes place only as the individual is required to put forth effort and that it is ethically and educationally unsound to make the environment antiseptic. Clearly this view could be pushed too far, especially where it would restrict efforts to promote sanitation, but in matters of individual choice it clearly follows the principles of Christ's teaching.

Ideas or practices may be obnoxious. Ideas or practices cannot be deported. There are two ways to deal with them. The source of the difficulty may be removed, or another body of ideas or practices may be set in motion that will overwhelm the obnoxious ideas or practices by their soundness, righteousness, or truth. The achievements of the youth clubs in Germany and the abandonment of drinking and smoking by German youths may be compared with the practices of youth in America in this respect.

Sleep and the Nervous System.—The cause of sleep is explained by several theories. One holds it to be due to lack of blood in the brain; another explains the phenomenon in terms of the chemical products of fatigue. Kleitman[1] has been experimenting at the University of Chicago and affirms that sleep comes from a decrease in the number of nerve impulses coming into the central nervous system from the sense organs plus the relaxation of muscles. Doubtless the onset of sleep is due to complete muscular relaxation, either voluntary or involuntary.

The work of Kleitman is discussed in a recent editorial of the Journal of the American Medical Association[2] as follows: "In an investigation recently reported from the University of Chicago,[3] a number of adult persons were sub-

[1] Kleitman, N.: Studies on the Physiology of Sleep, *American Journal of Physiology*, March, 1928.
[2] February 4, 1933, p. 340.
[3] Kleitman, Nathaniel: Diurnal Variation in Efficiency, *Science*, 76: 570 (December 16), 1932.

jected to several simple tests at different times of the day, and variations in performance were noted as regards the length of time required to carry out a certain task, or the number of errors made in a definite period of time, or both. The tests were made five times daily, for at least twenty days. The results obtained indicate a well-marked variation in performance during the day, efficiency of performance increasing up to noon or afternoon and then declining for the rest of the waking period. The body temperature varies in the same sense. There are indications that the temperature is dependent on the tonus of the skeletal muscles, in that it falls on lying down and rises on getting up. Kleitman adds that, if the variations in temperature can be used as a criterion of changes in tonicity of the body musculature, it would appear that the gradual decrease in efficiency toward the end of the day might be due to greater muscular relaxation, which leads to a decrease in the number of proprioceptive impulses reaching the cerebral cortex and makes it increasingly difficult to maintain the state of wakefulness, irrespective of whether or not any fatiguing work was done during the day. It is hardest to keep awake during the early hours of the morning when the body temperature is lowest. Under ordinary conditions, Kleitman concludes, going to bed in the evening results in a still greater muscular relaxation, and sleep is precipitated. After all, these phenomena of human physiologic behavior are familiar from practical experience. What one fails to remember is that work and weariness play a part in determining human efficiency in a way that the individual worker—notably the intellectual worker—all too often forgets."

Rest is essential to the restoration of energy in the body and particularly in the nervous system. Sleep is one of the best ways of resting. With children and usually with adults sleepiness in the morning means that the individual is not getting enough sleep. Wakefulness till late at night is a sign of too much brain activity or too much excitement. The following table of the number of hours of sleep for different ages is standard:

Age.	Night time.	Afternoon nap or rest.	Total hours.
4– 6........	6 or 7 P. M.–7 A. M.	1 hour	13 or 14
6– 8........	7 or 8 P. M.–7 A. M.	1 hour	12 or 13
8–10........	7.30 or 8 P. M.–7 A. M.	½ hour	11½ or 12
10–12........	8 or 8.30 P. M.–7 A. M.	½ hour	11 or 11½
12–14........	8.30 or 9 P. M.–7 A. M.		10 or 10½
14–16........	9 or 9.30 P. M.–7 A. M.		9½ or 10
16–18........	9.30 or 10 P. M.–7 A. M.		9 or 9½
18 or over....	10 or 11 P. M.–7 A. M.		8 or 9

Insomnia.—Inability to sleep is insomnia. This condition may be a symptom of disease, as in typhoid fever, but in health it is usually due to controllable factors. Lack of out-of-door exercise, drinking coffee or tea, overeating, mental work just before retiring may prevent sleep. Worry over other occurrences or worry over the fact of insomnia itself are important causes of sleeplessness. In going to sleep quickly habits are important. Relaxation of the body generally and particularly relaxation of the eye muscles should be secured. Taking a walk in the open air, indulging in a warm bath are favorable to sleep for many people. As a general rule one will sleep readily and soundly if there has been out-of-door exercise to produce fatigue, if the evening meal is light, and if the mind is free from worry.

QUESTIONS AND EXERCISES

1. Name the two nervous systems.
2. List the functions of these two systems.
3. Give specifically the functions of the cranial nerves; of the spinal nerves; of the afferent nerves; of the efferent nerves.
4. What is the part of education with relation to the nervous system?
5. Why should a balance be maintained between the activities of the two systems?
6. What are the dangers that the training of the autonomic will be neglected in the effort to train the cerebrospinal system?
7. Show that training of the nervous system can make a contribution to the health of the individual.
8. What is the significance of defective heredity in the nervous system?
9. State some of the essential factors in maintaining the health of the nervous system.
10. List the characteristics of normal mental life.
11. State the effects which an emotional upset may produce; which worry may produce.

12. Name two elements involved in insanity.
13. Give causes of insanity.
14. State effects of alcohol upon the nervous system.
15. Discuss the various theories of sleep.
16. How may sleep be induced normally?

CHAPTER XIII

HYGIENE OF THE SEXUAL ASPECTS OF LIFE

I. Anatomical and Physiological Backgrounds.
II. Meaning of Social Hygiene.
III. The Sex Instinct in Life.
IV. New Interpretations of Sex.
V. Psychical, Social, and Esthetic Meanings of Sex:
  1. An Education of the Senses.
VI. The Institution of Marriage:
  1. Birth Control.
VII. Menstruation.
VIII. Pregnancy.
IX. The Menopause.
X. The Social or Venereal Diseases:
  1. Gonorrhea.
  2. Syphilis.

Anatomical and Physiological Backgrounds.—The function of the male reproductive organs is to mature sex cells (spermatozoa) and deliver these to the female; that of the

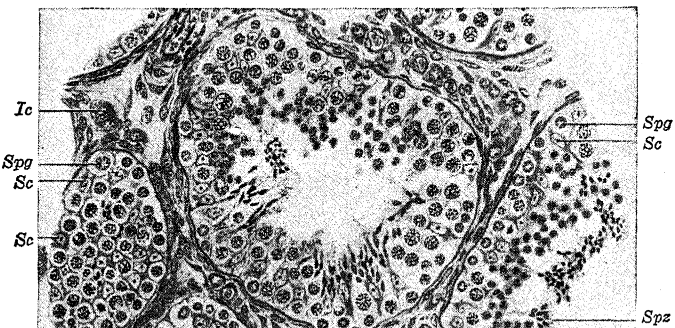

Fig. 138.—Seminiferous tubules in cross section, highly magnified. *Ic*, Interstitial cell; *Sc*, sustentacular cell; *Spg*, spermatogonium; *Spz*, spermatozoa. (Maximow-Bloom.)

female is to mature sex cells (ova), to receive spermatozoa from the male, and to develop the ovum after union with a spermatozoon into a human infant. This is nature's way

of perpetuating the human species. The process, however, has many emotional relationships because in addition to mating of the two sexes, there are the practices of humans

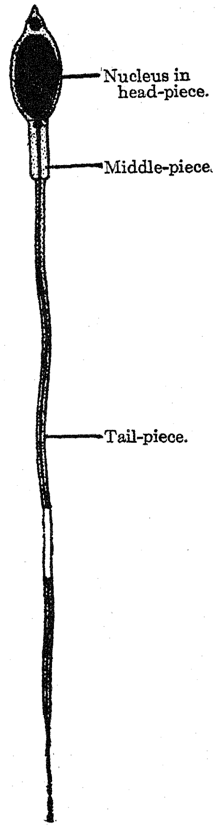

Fig. 139.—Diagram of the flagellate spermatozoon. (From Wilson, The Cell in Development and Inheritance.)

to form homes, to establish marital ideals, and to promote social standards.

The Testes and Their Secretion.—The testis is a glandular organ suspended in a pouch called the scrotum. From the

gland cells of the testes spermatozoa are given off (Fig. 138). These pass by ducts through the groin to reach the pelvic basin where they empty into a sac called the "seminal vesicle."

The spermatozoa are small, flagellated cells (Fig. 139) with the power to propel themselves. This motility enables them to travel from their place of deposit in the female tract to the ovum—the place of meeting is usually in the

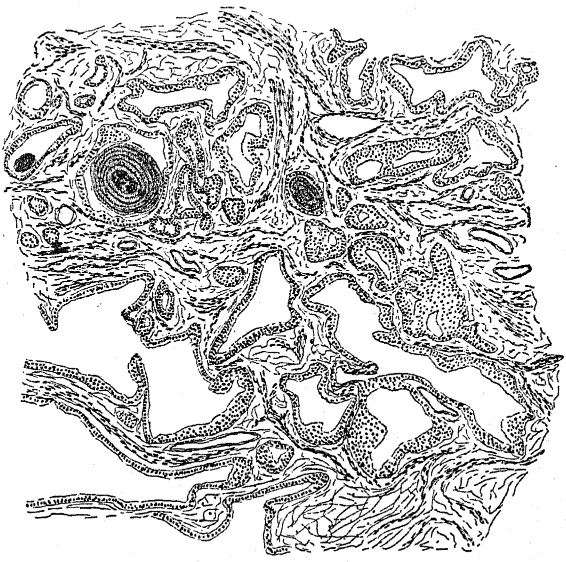

Fig. 140.—From section of prostate gland of man.

fallopian tube. They are produced in very large numbers. On entrance to the female tract, conception is almost certain if an ovum is present.

The fluid accumulated in the seminal vesicle is called "the seminal fluid," "spermatic fluid," or "semen." It contains spermatozoa, and other secretions from the tract. When the contents of the vesicle are discharged, a secretion from the prostate gland is added to it on its way through the gland.

Normally the seminal fluid is discharged in sexual intercourse. After the individual matures sexually the seminal vesicles become distended with secretion from time to time and this may be discharged automatically. This act is apt to take place at night during sleep and hence is called "nocturnal emission." It does not denote abnormal function.

The Prostate Gland.—The prostate gland lies below the bladder and surrounds the first portion of the male urethra. It is composed of many branching glands that open into the urethra, providing a secretion that is discharged when the seminal vesicles empty. The branching canals and tubes of the gland comprise an exceedingly complicated maze that is

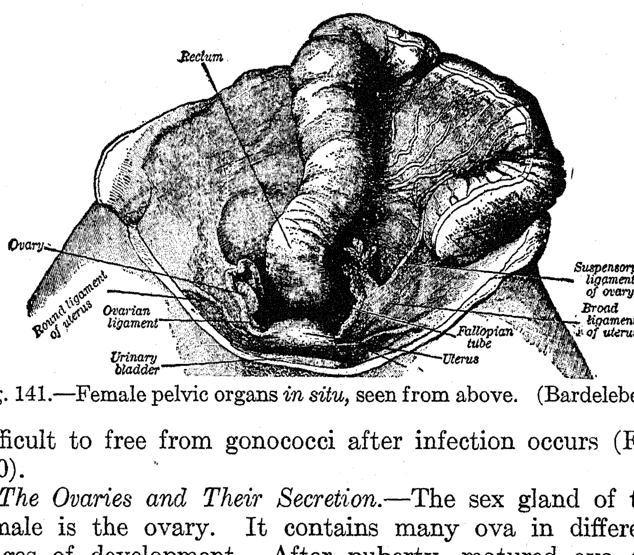

Fig. 141.—Female pelvic organs *in situ*, seen from above. (Bardeleben.)

difficult to free from gonococci after infection occurs (Fig. 140).

The Ovaries and Their Secretion.—The sex gland of the female is the ovary. It contains many ova in different stages of development. After puberty, matured ova are given off. In most cases, an ovum matures every twenty-eight days; the follicle in which it has been growing ruptures (Fig. 5), and the ovum is free.

The ovaries are located in the pelvic basin near the ends of two tubes that connect centrally with the uterus (Fig. 141). These are the fallopian tubes. When the ovum escapes from the ovary, it enters the tube and slowly travels toward the

uterus. If spermatozoa have entered the tube, the ovum is surrounded by the many male sex cells that are present. By some selective action, the procedure of which is unknown, the ovum permits one spermatozoan to penetrate its wall. Many hovering around are excluded.

This act results in fertilization of the ovum. The two cells have united and a new human individual is started. The fertilized cell continues on its way to reach the uterus where its full development over a period of nine months is to take place.

Development of the Fertilized Ovum.—A remarkable series of changes take place as the ovum develops into the human infant. These changes are described by the science, embryology. The mother, too, adapts to the new condition. The uterus grows in size, pushing upward and forward the abdominal contents. The bladder is compressed during the last month of pregnancy which accounts for the frequent urination at this time. As development of the fetus takes place, the marvelous adaptation of the uterus and indeed of all the cells and tissues of the parent is apparent. The birth of five living infants is so remarkable a phenomenon that all the world wonders. But the achievement is wholly feminine. In one seminal emission there are a sufficient number of spermatozoa to fertilize many hundreds of ova, but in the human, the fertilization of one ovum by one spermatozoan is the rule—with the usual exception.

The Uterus.—This organ, called by the laity, the womb, is a pear-shaped muscular structure. At its upper portion on either side extend the fallopian tubes. Below a portion, called the cervix, extends into the vagina. At regular intervals, in many women every twenty-eight days, the lining membrane of the uterus undergoes a pronounced change in preparation for the potential reception of a fertilized ovum. These changes are marked by an engorgement of the organ with blood, and a thickening of the lining membrane. If a fertilized ovum does not appear, blood from small capillaries in the lining membrane slowly exudes and the menstrual "flow" appears. Menstruation lasts for several days but the duration is variable in individuals. These

changes in the uterus are initiated by a secretion produced in the ovary at the time of ovulation. This secretion taken into the circulation reaches the uterus upon whose cells it has a specific action. This is another illustration of the action of an internal secretion, or autacoid.

Meaning of Social Hygiene.—The *hygiene* of the *reproductive system* would be the logical term to use in sequence to the previous chapters, but here, as elsewhere, the logical does not always serve. The hygiene of the reproductive system would relate to the care of the reproductive organs, to menstruation, to pregnancy and labor, and to the prevention of disease. The sex instincts, however, relate to the whole of life and touch problems that reach into all aspects of life. The hygiene of the sexual aspects of life, known as social hygiene, concerns itself not only with the hygiene of organs, but indeed also with the institution of marriage, social customs, prostitution, perhaps even the Malthusian movement. The finest forms of life can develop only where work, play, friendship, love, and worship are continually expressed in fine forms and under high standards.

Social hygiene, broadly conceived, is a fundamental approach to many of the most important problems of living. The phenomena of sex are never isolated; inevitably they bear upon or intertwine with all of life that is lived, gloriously or tragically. Popenoe of the Institute of Family Relations, Los Angeles, found that of 500 cases coming to the Institute in 1930, all but one showed sexual maladjustment as a complicating factor. McChristie of Cincinnati found that of 600 cases of alleged gross neglect and cruelty 97 per cent indicated sex antagonism or maladjustment.

Social hygiene in Europe means general hygiene but in America the term refers to an expert and highly organized effort to prevent or cure the health and welfare problems which have a direct or indirect origin in the fundamental phenomena of sex and which concern the family as the basic unit in society. Serious problems of sex such as syphilis, gonorrhea, prostitution, rape, and birth control (although the last is not the same kind of problem as the preceding) have large social implications, but within marriage as well

as outside this institution there are many other personal problems of great importance to individuals.

The Sex Instinct in Life.—If the instincts of man be studied, it will be found that they group themselves into two categories—one looking toward preservation of the individual, the other toward perpetuation of the race. The first is personal, real, and conscious of its end; the second is personal, real, but largely unconscious.

Freud earlier claimed that the sex instinct is the root of all life activity, whether sexual, intellectual, or physical. In the years that have passed he has retreated from that position and today interpretation of the libido includes many motivations and urges other than the sexual. Freud, however, has made clear to informed persons the full meaning of this force; all students of life know that this instinct is not a simple thing at all, but that it is, at least in its expressions, bound up with most of the human problems of the sexes.

The life impulse has worked itself out in a variety of ways. In the plant world there are asexual and sexual forms of reproduction providing for the perpetuation of the species without the guidance of instinct or intelligence. In the animal kingdom the maintenance of species has been entrusted to the sex instinct. With the lower animals this instinct is marvelous in its skill in acquiring just the proper conditions for effective action. The beetle *Sitaris* is a wonderful illustration of the power of this instinct to provide for life, to satisfy its essential purpose.[1]

With man, however, nature departed from her scheme of the animal world by bringing in intelligence. If instinct had ruled in the primates such as man, there would not, of course, be the civilized life of a modern man, the social disharmonies, prostitution, and the whole chain of social ills that have arisen for modern man. Instinct in man as the supreme force would have given a life comparable to that of the lower animals. The development of intelligence made possible the forms of civilized life, the economic achievements of society, and the moral and social advances of the

[1] Bergson, H.: Creative Evolution, Henry Holt & Co., New York, 1913, p. 146.

race. The chasm between instinct and intelligence as shown in human life accounts for most of the social disorders of the race.

Sex conduct if guided only by instinctive urge is on the level of lower animal life; if directed by intelligence and the forces of the affective life, it can be made to contribute to life values in the same way that intelligence has enriched life in other fields.

The working of the sex instinct under conditions imposed by modern civilized environment leads to numerous problems upon whose successful solution the health, happiness, and welfare of the individual, the family, and therefore the community largely depend. Obviously these problems are not to be solved by referring them either to the operation of instinct or to the traditional taboos of conventional society that, in the past, has been afraid of sex and unwilling even to discuss the problems that emerge in all strata of social life. Intelligence must be brought into the situation.[1]

It is probably true that the whole of life, sex, emotions, spirit, work, play, and love are best achieved and best expressed when intelligence rules and guides and when the purely instinctive elements are controlled. Moreover, evolution is continually developing such control. Human conduct today is different from the human conduct of two thousand years ago. The young person interested in achieving the finest life will be guided by the compelling dictates of intelligence and not by the force of instinct in all manifestations of sex in life. This will mean, then, that intelligence is to control, to direct, to approve, or disapprove of instinctive desire.

[1] For those interested in the sex education of youth the following books will be helpful:

Dennett, M. W.: Sex Education of Children, Vanguard Press, New York, 1931.

Dickerson, R. E.: So Youth May Know, Association Press, New York, 1929.

Elliott, G. L., and Bone, H.: The Sex Life of Youth, Association Press, New York, 1930.

Ellis, H.: Little Essays on Love and Virtue, Doran Co., New York, 1922.

Van Waters, M.: Youth in Conflict, Republic Publishing Co., New York, 1925.

New Interpretations of Sex.—The sex instinct denotes a great desire. Its free expression has led to such disturbances in society that controls of various kinds have been established over the years.

Recently the philosophy of self-expression has led some persons to believe that any control over self or any suppression of instinctive urge will inevitably lead to ill health and that only the fullest self-expression can safeguard health. This is, of course, erroneous. Indeed, ill health may result from self-expressive activity; the test of these two extreme views is the very practical one of nature and effect. What is being suppressed? What is being expressed? What effects emerge? How does this influence human personality? What are the effects on other persons? Such questions test more effectively the worth of any view than the arguments elaborated in developing a philosophy. Moreover, the nature of man offers no ready justification for the view that one may do as one pleases.

Science recognizes no such interpretation of nature. For the intelligent no value is conserved by such distorted view. Rather, must there come into our consciousness an appreciation of the beautiful aspects of sex. The sexual life in man must be conceived as a different sort of thing entirely from that among the lower animals. True, it issues in the production of new individuals, but just because man is man, a being of intelligence, it differs in its "high spiritual meaning and purpose."

It is just this thought that prompts the following statement of fundamental principles in the Report on Social Hygiene Education.[1]

"Human meanings of sex: It is only by frankly recognizing and developing the psychical and social and esthetic meanings of sex, that are distinctly human and superadded to the merely propagative function of the animal, that people can be led far away from the almost universal secrecy, disrespect, vulgarity, and irreverence concerning every aspect of sex in human life. Sex instincts and proc-

[1] Teachers College Bulletin, Twelfth Series, No. 13, Teachers College, New York, 1920.

esses are essentially pure and beautiful phases of that wonderful something we call 'Life.' Sex education should aim to give this *esthetic attitude* by presenting life as fundamentally free from the degradation arising from the common misuse and misunderstanding of the sexual nature."

Psychical, Social, and Esthetic Meanings of Sex.—The policy of silence about sex matters to which young persons have been so generally subjected leads to crude and loutish notions or strange and fearsome concepts of intercourse. This policy has not been consciously formulated; it developed out of ignorance, it was maintained by fear, and it persists by means of the traditional inertia of the social mass. It is exceedingly difficult for one generation to alter the customs and standards handed down by a preceding one. Some advances have been made in recent years toward a saner view, and sex problems are discussed today with a frankness that was quite impossible in the latter decades of the nineteenth century. Little progress has been made, however, in formulating and in teaching to young people an appreciation of the psychical, social, and esthetic meanings of sex. Progress in this will be slow until it is understood that such meanings relate not to sex alone but to the whole of life. The meanings of sex may be deepened only as living acquires significance, psychically, socially, and esthetically.

It will appear obvious that the simple biological facts of sex are not an adequate background from which to answer the questions that many young persons ask today. The questions asked by college students afford a fair sample of the problems that bother them. One student asks, "If I intend to postpone marriage until I get my M. D., just how am I to handle the sex problem?" At one time, he might have been answered by advising continence until marriage, but desirable as that is, the problems of sex are not solved by continence. Even after marriage he may have a greater sex problem; he may marry a girl who is ignorant about or ashamed of sex and his medical training is not apt to tell him anything about the art of love. The psychical meanings of sex must be discovered.

Another student asks, "What do you advise a boy to do if he is in 'a jam' but doesn't wish to marry the girl?" Different answers would be given by different persons, but even if this "jam" is broken up, another is apt to result unless the student understands and appreciates the social meanings of sex.

The social meanings of sex are well illustrated in the conduct of a man who infects his wife with syphilis allowing her to transmit this disease to an innocent child. Obviously such behavior is socially far more injurious than violation of certain sex taboos of ancient origin. To view sex in relation to social consequences is one important aspect of social hygiene.

Another student asks, "Which is worse, homosexuality or normal sex relations?" It is a fair question if normal sex relations are possible for a person who has doubt about the relative values in homosexuality and normal intercourse. Until the esthetics of sex are developed, the experience in sex is apt to be crude, like gluttony or drunkenness, an affair without beauty or significant expressive meanings.

The teaching of the psychical, social, and esthetic meanings of sex should center in the family. No other social institution can replace the home for this purpose although the church, school, and college may give valuable assistance. Failure of parents to sense the problem in the past and to proceed intelligently in the matter accounts for the seriousness of the sex situation today. Parents must learn that the values in particular standards and customs depend upon the meanings that can be developed therein. The truth of this is obvious in such practices as tipping the hat, going to church, rising from one's seat in the presence of elders, and others. As youth understands and appreciates the sentiments or meanings behind such acts, they acquire psychical, social, and esthetic significance. When such sentiments are the actual possession of a person, his problems in courtesy, religious worship, and respect become easier. The health and welfare of a community reflect in some degree, quite inexpressible in statistics, the extent to which standards of citizens are real, customs sincere, and practices thorough-

going expressions of convictions and purposes. In similar fashion the problems of sex are to be solved by deepening the psychical, social, and esthetic expressions of life and not alone by attention to medical or sanitary matters.

Moreover, it is not particularly helpful to view the sex urge as a biological phenomenon for the obvious reason that human society is characterized by forms of social life in which sex has other meanings also. When the other meanings are ignored and only the biological are recognized, living becomes exceedingly difficult because these other meanings emerge. Although developed in civilized society and superimposed upon the biological, they are very real.

An Education of the Senses.—The literature of the second and third decades of the present century portrays the disillusionment in contemporary life. The generations of these years have been quite unable to find the motive for saying, "Life is real, life is earnest." The war destroyed complacency and peace of mind. But the machine age had begun to do the same thing. No one can live in the noise, grime, and routine of city life without, at times, profound feelings of futility. To the disillusionments of contemporary society have been added the severe pressures and emotional strains of the depression. It is not strange, therefore, to find large numbers of people unhappy, discouraged, without faith in the goodness of any life, to say nothing of the future one. In this situation many have turned to sex as others have turned to alcohol. The need to correct the economic conditions that have produced so much human misery is pressing, but the sick mind of man is not to be saved by economic therapy alone. In this emergency and as a continual policy, there must be a very much expanded and intensified education of the senses.

Moralists have been afraid of sense. The dance, colors, music, beauty, odors, indeed all the sensory manifestations in which man takes pleasure and satisfaction have a traditional taboo.

To give oneself to the pure delights of melody and harmony, to join in the ecstasy of a beautiful dance, to lose oneself, not in contemplation of a financial merger but in

the view from the twelfth hole, is by certain standards little less than sin. But the fact remains that the rôle of the beautiful must be established if life is not to be dull and uninteresting. Esthetic and psychical meanings of sex must replace the conventional ideas of shame, sin, lust, and similar concepts. Love between two persons is a human relationship with possibilities for rich psychical and esthetic meanings but it is not always realized. The art of love is a possible art but it can never be developed if sense is feared. Nor can it be developed with satisfaction outside the home and marriage. These institutions, realistic expressions of sex, condition and control the art of love. Promiscuity is not a contribution to marriage, the home, or children.

The Institution of Marriage.—Marriage is a human institution serving in the establishment of homes and the rearing of children.[1] It has profound possibilities for unhappiness and social distresses; it has sublime possibilities for happiness and social progress. Probably its values far outweigh its failures; certainly society would be less satisfying for all without marriage. In the paragraphs that can be devoted to its discussion in this book only a few outlines can be traced; adequate treatment would require a volume in itself. Yet in a little space some very important matters affecting health and happiness can be set forth.

There is a need for a broad general understanding of marriage by young men and women.[2] What does it mean? What does it give? What does it require? First and foremost in any catechism of marriage would appear the statement: *Young people should value, in the opposite sex, things other than the sexual merely.* Sex attraction is not enough to be satisfying for the whole of life. Winds of feeling are not fair weather for the matrimonial venture. They are too

[1] Castle, W. E.: Genetics and Eugenics, Harvard University Press.

[2] Addams, J.: A New Conscience and an Ancient Evil, The Macmillan Co., New York. Ulrich, M. S.: Mothers of America, American Social Hygiene Association, Publication No. 180, New York, Bigelow, M. A.: Sex-Education, The Macmillan Co., New York, 1916. Everett, M. S.: The Hygiene of Marriage, The Vanguard Press, New York, 1932. Yarros, R. S.: Modern Woman and Sex, The Vanguard Press, New York, 1933.

gusty. The human vessel needs the support of an auxiliary engine to supply appropriate power in the form of interests and ideals.

Marked incompatibilities should be avoided: The man interested in camping, out-of-doors, and the woman not interested; the woman fine in her appreciations, manner, and standards, and the man coarse; the woman artistic, and the man crude; the man ambitious, productive, with a strong social sense, and the woman a creature of decoration, only to be entertained. The power of the sex appeal is often not great enough to hold together in comradeship, happiness, and enduring love the man and woman of no common general interests.

The young man and young woman should have enough imagination to see that married life is not one continual act of love making in the usual sense of that term. That there should be expression of love cannot be denied, but the broad general common interests of life are the channels through which love may be continually set free and expressed, and true comradeship developed. And yet a realistic view of marriage will not ignore the part that sex plays in happy companionship. Popenoe of the Institute of Family Relations reports that of 500 cases coming to the Institute in 1930, all but one showed sexual maladjustment as a complicating factor. Due to the general ignorance regarding the sex life and the ancient taboos that prevent normal and natural expressions, a great number of married people never understand sexual mating.

There are those who would have marriage to begin and to end at will. At the other extreme are the orthodoxists who would make of it an indissoluble bond. Perhaps somewhere between lies the golden mean in which all the social and all the individual values will be preserved. Certainly there will be less reason for extreme positions if the male-made double standard of morals can be abolished, and if the male-made institution of prostitution can be broken down. Marriage can mean all that it ought to mean if one principle is remembered: Everything exchanged between husband and wife can only be the free gift of love, can never be de-

manded as a right.[1] Love never demands. The tenderness of love, the thoughtfulness of love, the sacrifice of love are the portals to love itself.

When shall young people marry? Biologically they are prepared to assume the reproductive functions in adolescence. But society with its economic demands, its plans of education, its organization of trades, occupations, and professions has gradually prolonged the marriageable age.[2] The young man should never feel that he has solved the control of the sex impulse by marriage; he has as great or greater need for control after marriage. This control is necessary during certain physiologic periods and also during pregnancy.

The idea of the "companionate marriage" is to permit marriage early and in accordance with biological facts and to afford financial aid until the economic life of the participants can be established. This plan is a recognition of the tendency of modern life to cause delay in marriage and illustrates the increasing participation of parents in the problems of child welfare. There seems to be lacking something of courage, independence, and control in young people who accept the "companionate" plan, and yet this idea

[1] The thought is expressed by Ellen Key in her book, The Morality of Women, Ralph Seymour Co., Chicago, 1921.

[2] The following books deal with the complex problems of marriage and the home:

Briffault, R.: Sin and Sex, The Macauley Co., New York, 1931.

Collier, V. M.: Marriage and Careers, Channel Book Shop, 1926.

Davis, K. B.: The Sex Life of 2200 Women, Harper and Brothers, New York, 1929.

Douglas, P. H.: Wages and the Family, University of Chicago Press, 1927.

Groves, E. R.: Marriage, Henry Holt and Co., New York, 1933.

Lightenberger, J. P.: Divorce: Study in Social Causation, Columbia University Press, 1909.

Popenoe, P. B., and Johnson, R. H.: Applied Eugenics, The Macmillan Co., New York, 1933.

Rich, M. E.: Family Life Today, Houghton Mifflin Co., 1928.

Ross, E. A.: Civic Sociology, World Book Company, Yonkers on Hudson, New York, 1925, p. 13.

Westermarck, E. A.: A Short History of Marriage, Macmillan Co., 1926.

Wright, H.: The Sex Factor in Marriage, Vanguard Press, New York, 1931.

requires something of all three qualities to break with tradition and social custom in this effort to solve an increasingly difficult problem.

Interest in education for marriage[1] has grown with the years and increasing attention is given in the schools to the various phases of homemaking. Progress in this direction will depend upon a functional rather than a literary view of education, and upon the selection of teachers who have a point of view that can be helpful to young persons. The curious notion that there was nothing of substantial mental content in home economics and in household arts generally has produced high school curricula devoid of useful and greatly needed information for marriage and homemaking. Education should help people to live better. Marriage can be improved with education of the proper kind.

Menstruation.—For the woman the menstrual period involves certain marked physiologic changes. These are more marked on the psychic side in the few days before the period. During the period the woman should live the usual life if possible, avoiding undue fatigue, work, or strain. Vigorous running and jumping are not to be advised, and yet moderate exercise is helpful.

It is entirely correct to bathe the body at this time and to keep clean. This should be accomplished by a sponge bath, tub, or shower. Douching during the menstrual period is not necessary or desirable. During this period, also the feet should be kept dry, the body not exposed to cold, and plenty of rest in sleep indulged at night.

For menstrual pain, special abdominal exercises will be helpful in certain cases. Persons having dysmenorrhea have weaker abdominal muscles than do those having normal menstrual periods. Strengthening of abdominal muscles may either prevent or correct certain types of dysmenorrhea.[2]

Pregnancy.—During pregnancy exercise should be con-

[1] Downing, R.: Elementary Eugenics, University of Chicago Press, 1928.

[2] Hammer, M. C.: Dysmenorrhea and Its Relation to Abdominal Strength as Tested by the Wisconsin Method, *The Research Quarterly*, March, 1933, p. 229.

tinued daily and plenty of time spent out-of-doors—at least a walk of 2 miles, and one hour in the open air if possible. The diet should be supervised and the condition of the patient carefully determined by the physician in charge. After the birth of the child every reasonable effort should be made to nurse the baby because the child has more chances for life and, moreover, it is better for the mother.[1]

All expectant mothers should refrain from using alcohol and excessive smoking throughout pregnancy. They should be protected against dangerous disease in industry, especially lead poisoning. Attention to the teeth, bowels, and kidneys is vital at this time.

The Menopause.—The menopause or "climacteric" is a cessation of menstruation accompanied by manifestations of general symptoms. Today it is understood that these are phenomena of glandular activity involving the ovary, pituitary, thyroid, and adrenal. After forty years of age the thickening of the sheath of the ovary begins, and at variable periods in this and later decades, the ovarian follicles erupt with difficulty. This failure of the follicle to produce ova results in a failure to produce the subsequent corpus luteum, and the change in menstrual flow is indicative of the absence of progestin, the hormone from the corpus.

The pituitary gland maintains a relationship with the gonads, producing a principle that is a stimulus to the ovarian follicles to mature, erupt, and produce progestin.

The thyroid and adrenals depend upon anterior pituitary secretion, and hence after the menopause when ovarian inhibition of the pituitary is lacking, there may be an excess activity of the thyroid. Many of the nervous symptoms of this period are due to hyperthyroidism. Sometimes there are disturbing mental symptoms. Women in the years of the menopause should have the advice of a competent modern physician.

The Social or Venereal Diseases.—The social diseases, gonorrhea and syphilis, are, in the main, diseases contracted in clandestine or organized prostitution. Some cases are

[1] West, M.: Care of Children Series, Nos. 1, 2, and 3, Children's Bureau, U. S. Department of Labor, Washington, D. C.

acquired asexually, but they are, in the main, the vaginitis[1] cases seen in institutions for girls, such as asylums or orphanages. Commercialized or clandestine prostitution provide the chief infections.

The venereal diseases constitute one of the most serious handicaps and hazards for any health plan that confronts society today. The extent of these diseases cannot accurately be stated. That it is very great is suggested by the number of cases of gonorrheal ophthalmia and syphilitic insane, by the sterility in men and women, and by the abdominal operations on women occasioned by gonorrhea. It has been estimated that a large proportion of the operations on married women for abdominal conditions are occasioned by gonorrhea transmitted by the husband, supposedly cured of the disease. The extent of the infection in the nation is not accurately known, but the possible and frequent results of the infection is a well-known medical fact.

Feldman[2] suggests that prenuptial clinics should be established where persons of both sexes could get expert advice as regards their fitness to marry, and no person knowingly suffering from syphilis should be allowed to marry. There are many arguments against such kind of control but if education is unable to develop a worthy and adequate social sense in mankind, then something of the kind proposed by Feldman may be required.

Gonorrhea.—This disease is caused by the gonococcus (Fig. 142), an organism that is grown with difficulty in artificial media, that dies soon on exposure outside the body, but that grows with rapidity on the mucous membrane of the genito-urinary tract and on the mucous membrane of the eyes.

Contrary to popular opinion, it is not an insignificant disease. The initial symptoms may pass quickly, but the complications are serious and almost always result. In the male there may occur stricture of the urinary passage, in-

[1] There is some evidence that the asexual vaginitis cases are not caused by the gonococcus. Relationship not definitely determined.

[2] Feldman, W. M.: Prenatal Hygiene, *British Journal of Children's Diseases*, October-December, 1926.

volvement of the prostate gland, and infection of the sperm ducts leading from the testes, producing sterility at times. The disease may extend throughout the body, involving the joints and producing an inflammation that results frequently in stiffness and loss of motor function. At times the heart itself is involved, and less frequently other body structures.

The disease is exceedingly difficult to cure. Even after all the symptoms have cleared up gonococci may still remain in the prostatic glands; when discharged later, they are able

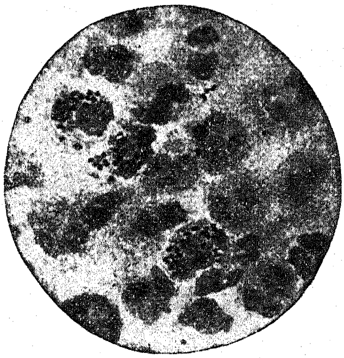

Fig. 142.—Smear from gonorrheal pus. The gonococci are the small dots. Some are within the cytoplasm of leukocytes (× 1100). (Hicks.)

to produce the disease. A cure can be prognosticated only after two tests have been made:

1. Massage of the prostate and examination of the secretion under the microscope for gonococci.
2. The complement-fixation test for gonorrhea.

In the female the complications may result more disastrously. In addition to the local disturbance, infection of the tubes and ovaries is almost certain to occur. This results frequently in sterility, and often requires an abdominal operation for removal of the diseased organ. Not infrequently the removal of both ovaries is necessary, thus producing an artificial menopause, and causing the woman continuous ill health and nervous disturbances.

In the female treatment is very unsatisfactory. Some gynecologists question if a complete cure is ever secured; all recognize its extreme difficulty.

For any young person to look upon this disease as insignificant and to ignore the scientific evidence available are signs of ignorance or stupidity, or both.

Syphilis.—This disease is caused by a spiral-shaped organism, the *Spirochaeta pallida* (Fig. 143). It produces a disease that may attack any part of the body structure. The course of the disease is divided into three stages:

The first stage is marked by a characteristic sore or lesion, usually on the genitals. The second stage presents a typical sore throat with characteristic patches, an eruption on the

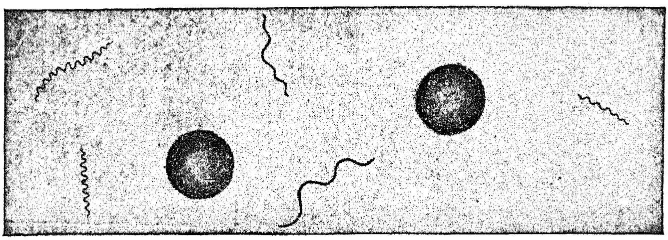

Fig. 143.—Spiral organisms. The two at the left are the causative agents of syphilis. Two red corpuscles are also shown (× 1200). (Todd and Sanford.)

skin, and at times such disturbance of nutrition that the hair is lost in characteristic fashion. The third stage sets in anywhere from two to twenty years after the original infection with disturbances in the bones, joints, liver, heart, blood vessels, and nervous system.

In addition to the serious effects upon the individual himself the disease may be transmitted to offspring by prenatal infection, so that the succeeding generation may be syphilitic.

In both male and female the disease may be cured in the early stage of the disease with thorough treatment by a reputable physician. For syphilis of the nervous system no satisfactory results have been secured in treatment. Locomotor ataxia may be checked in its development and a

certain amount of muscular reeducation accomplished, but, in the main, the results must be considered as meager.

Again, as in gonorrhea, we have a disease that is capable not only of destroying the health of the individual but also, and quite as important, wrecking his life and bringing strains and stresses upon family and friends that are unfair and unwarranted.

There is a sort of justice to the dissolute when syphilis produces an aneurysm of the blood vessels or causes his disablement or death by disease of the nervous system. He pays the price with his life. But here, as in all diseases contracted selfishly and without thought of and care for others, it is most unfair to family and friends to be a burden and care through the years of adult life because of selfish and uncontrolled desires in youth.[1] The social meanings of sex are often tragically illustrated in the lives of those who acquire venereal disease.

Here, as elsewhere in life, the problem of living well is the problem of seeing straight, of not getting values mixed. The important matters in life relate not to wealth or to social position, not to culture or to vocation, but to the eternal truths of all time. To know the truth, to know thyself in whom the truth really lies—here is the magic wand for health and happiness.

QUESTIONS AND EXERCISES

1. Enumerate the factors relating to the hygiene of the reproductive organs.
2. With what does social hygiene concern itself?
3. Show that the sex instincts relate to the whole of life.
4. Discuss the social, psychic, and esthetic meanings of sex.
5. Why are the human meanings of sex, contrasted with its purpose as propagation of the species, important?
6. Show through some common illustrations the conflict between instinct and intelligence.

[1] The following pamphlets published by the American Social Hygiene Association may be secured from the New York office for 10 cents each: Sex in Life, No. 52; The Boy Problem, No. 284; Health for Men, No. 283; Healthy, Happy Womanhood, No. 60; Keeping Fit, No. 55; Sex-Education in the Home, No. 61; Human Welfare and the Monogamous Ideal, No. 314; Conquering an Old Enemy, No. 250; From Boy to Man, No. 626.

7. List interests of a young man and a young woman who might be very companionable. List incompatibilities that might interfere with successful marriage.
8. List the chief sources in the occurrence of the venereal diseases.
9. Why is syphilis such a serious disease?
10. What attitudes should the study of social hygiene give to high school pupils?
11. What are the social implications of the venereal diseases?

CHAPTER XIV

PREVENTION IN SPECIFIC DISEASES

I. Anatomical and Physiological Backgrounds.
II. The Emphasis of Hygiene.
III. The Universal Distribution of Disease.
IV. Types of Disease.
V. Causes of Disease.
VI. The Transmission of Disease.
VII. The Prevention of Disease:
  1. General Means of Prevention.
  2. Special Means of Prevention.
VIII. Prevention of Communicable Disease.
IX. Prevention of Nutritional Disease.
X. Prevention of Acute Poisoning.
XI. Prevention of Chronic Disease of Middle Life.
XII. Prevention of Functional Nervous Disease.
XIII. Prevention of the Local Infections.
XIV. Prevention of Cancer and Tumors.
XV. What Are the Chances?
XVI. Summary.

Anatomical and Physiological Backgrounds.—The backgrounds of disease constitute the morbid anatomy and pathology of disease; and these are myriad in their forms. It may be helpful, however, to attempt to make clear some aspects of disease that bear upon problems of hygiene.

It is important to note that often it is difficult to draw a sharp line between health and disease. The individual suffering from typhoid fever is easily distinguished, and other clinically recognized conditions are readily diagnosed. It is in disturbed functions, however, that the chief difficulty arises. If a person loses a tooth, has a flat foot-arch, or develops astigmatism, is he healthy; has he disease? Emphasis has been given in preceding discussions to an organismic view of the individual and attention called to the many examples of correlation and coordination that exist. If the heart is injured, is more than heart involved? If a tooth is lost, is more than that one tooth missing? The unity of

the organism is so profound a fact that disturbance in any one area is apt to have effects generally. This is more impressive when the site of disturbance is a part performing an important function. When an ankle is badly sprained, the effort to carry all the weight on one leg, in an attempt to save the injured member, may produce injury to the arch of the unsprained foot. When a tooth is lost, the opposite, above or below, loses its efficiency. When one eye is injured, the other does double duty. And yet, it is known that a local disturbance may exist along with a general state of well-being. Moreover, one may enjoy general well-being in a restricted manner of living, and would show unmistakable signs of disease in active life.

Disease may manifest itself, then, not only in clinical types, such as pneumonia or appendicitis, caused by microorganisms; not only in deficiency diseases, such as pellagra; but also in manifestations of functions outside the limits of individual efficiency.

Health disturbances may be inherited, as hemophilia, or acquired after birth. They may be classified as to cause and the effort of all science is to explain phenomena in terms of causation. This is not always possible, and even when a single factor is known, its influence may be highly variable. For example, cold may cause frost-bite or death by freezing. Here the cause is clear. In other instances, cold may act as a predisposing factor lowering the resistance to disease, as in pneumonia. In both types, cold is a cause, but in the former, it is the exciting cause, in the latter the predisposing cause.

And finally, the individual himself may constitute in his own tendencies, a causative factor. Cancer develops in some persons, not in all. Constitution or body build predisposes toward certain forms of disease. Sex in the individual presents certain hazards; age period is a liability for certain disturbances; habits of living are powerful in producing disease; previous infections may influence secondary infections; and malnutrition is frequently a danger in children.

The Emphasis of Hygiene.—The time is past when one

thinks of disease as necessary. For many persons it is a grim reality, a dread specter continually threatening and at times grasping its victims. But the point of view in this book maintains that much disease is unnecessary, that its occurrence represents failure of some person, or persons, to observe the laws of healthful living. Consequently, the emphasis for living finely and well is always to be placed upon the ways and means of attaining and maintaining health.

The Universal Distribution of Disease.—The emphasis upon healthful processes should not shut us off from recognition of the fact of disease and the means of its prevention. Disease is a common phenomenon in all life. It varies with races, geographic location, climate, and mode of living. Complete eradication of disease, while not theoretically impossible, is not probable in the near future. Men will need to accomplish great studies in sanitation, in hygiene, and in improvement of racial stocks through application of eugenic principles. At present man is subject not only to a variety of diseases that are present all the time with marked seasonal increases in certain months, but is attacked at times with epidemic diseases that cause great gaps in the population. At times, assuming a world-wide character, a disease may sweep in severe form over the entire habitable world, as recently occurred in influenza. Such a manifestation is called a pandemic.

The studies made by scientific medicine in combating the prevalence and force of smallpox, bubonic plague, typhoid, syphilis, cholera, yellow fever, and malaria are tokens of promise that should hearten the race in its struggle for existence.

While the outlook is most promising with respect to the communicable diseases, the continued high death rate from the noncommunicable diseases of middle life presents serious problems to public health workers. The decrease in the general mortality rate is largely made up of the decrease in infant mortality. Here the saving of life has been tremendous. In New York City, comparison of the decrease in death rate in infants since 1900 shows a drop from 192

to 68 deaths per 1000 births, whereas the general death rate has decreased only from 20.6 to 12.8 per 1000. In fact, since 1921 the general rate in New York City has increased. This is rather significant because with the exception of the epidemic increase in 1917–18, the rate has been consistently downward for the last seventeen years, 1904–1921. Nevertheless, there is a percentile decline in New York City in all age ranges and although it is most marked in infancy it is also present in the upper groups.

The answer to this problem is not wholly clear, but that personal hygiene must help people to live more wholesomely seems clearly indicated.

Types of Disease.—Commonly, we think of the transmissible diseases when discussing the ills that affect the human body, but such view is incomplete and unsatisfactory. It is important to make clear the forms of disturbance which may arise in the body. They may be classified for our purposes into seven groups.

1. The communicable diseases.
2. The diseases of nutrition.
3. The acute poisons.
4. The chronic diseases of middle life.
5. The functional nervous diseases.
6. The local infections.
7. Cancer and tumors.

Causes of Disease.—The cause of disease has been a momentous question from early times. Curious beliefs have arisen out of the efforts of man to determine the reason for loss of health. The early philosophers, the medicine man of savage tribes, the modern types of the unscientific and irrational give illustrations of superstition, occultism, and frank ignorance at work on the problem. Whether it is "evil spirits" abiding in the person, or "subluxated vertebrae" pressing on nerves, or insufficient force of mind over matter, the cause seems to persist until attacked in laboratory and hospital with medical and surgical service.

The causes of disease are as follows:

1. *Causes of communicable disease:*
   (*a*) Bacteria which act by producing virulent poisons (toxins) destructive to the cells of the body.
   (*b*) Other organisms which as parasites act by producing poisons, by using up the blood of the host, and by obstruction of vital and important pathways and organs.
2. *Causes of nutritional disease:*
   (*a*) Absence of essential food elements, salts, or other matter from the diet.
   (*b*) Presence or absence of important secretions from the endocrine glands.
3. *Causes of acute poisoning:*
   (*a*) Poisons developed in animal matter, such as milk, meat, and fish.
   (*b*) Poisons developed in improperly canned vegetables and fruits.
   (*c*) Poisons from certain metals, such as lead, mercury, and phosphorus. These poisons come usually from certain trades in which these metals are used.
4. *Causes of chronic disease of middle life:*
   While heredity unquestionably plays an important part in these disorders, it is also true that improper living is chiefly the causative factor. Intemperate living as exemplified in mental or physical strain, mental or physical inactivity, too much or too little food or improper food. Certain cases are undoubtedly due to long-continued infections or the action of poisons over a period of years. Some cases seem to be associated with injuries and physical strains.
5. *Causes of functional disease:*
   There is included in this category those diseases of bodily disturbance due to maladjustment of the individual to life and represented by the improper functioning of the mind and emotions. Not infrequently there is a sexual basis for these disturbances; always there is a strong psychic force at work. The increase in this type of disease is to be expected so long as the standards of life remain what they are, and the social-economic strains continue without relief through a more wholesome and more scientific approach to the problems of human life.
6. *Causes of the local infections:*
   Included in this group are the pyogenic infections due to entrance of streptococcus or staphylococcus into the body.[1]
7. *Causes of cancer and tumors:*
   Included here are the various forms of carcinomata, tumors, or other wild growths. The causes are mainly unknown. In certain types causative factors are recognized.

The Transmission of Disease.—Bacteria may be transmitted directly from one person to another, as in tuberculosis, diphtheria, etc., or by means of agents, such as

[1] A local infection may become general, such as occurs in septicemia (blood poisoning). Care for infections of this type is very important so that general involvement of the body may not occur.

drinking water, milk, food, soil, or objects, such as cups, handkerchiefs, toys, money, books, clothing, etc.

Insects and vermin may carry the disease agent either directly as a host or indirectly through infection of food supplies. Malaria is the classic example of direct carrier, in which the mosquito acts as the host for the malarial parasite that reaches the blood stream of man by means of the bite of the infected mosquito. Flies are notorious agents for transmitting disease by contamination of food. Rats are indirectly responsible for bubonic plague by harboring the rat flea in which occurs the complete cycle of the organism causing the disease.

It is important to note, therefore, that disease-producing bacteria or parasites may be transmitted to man by:

1. Direct contact of the sick with the well,
2. Infection of food and drink supplies,
3. Contamination of articles used, or by
4. Insects and vermin which harbor the germs of certain diseases.

The Prevention of Disease.—The question of living finely, in the present state of society, frequently resolves itself into combating the prevalent agencies of disease transmission. Moreover, in addition, man must be awake to the dangers from improper food combinations, the hazards of acute poisoning, the menace of hereditary taint, the perils of degenerative disease, the attacks of pathogenic bacteria, and the deplorable functional disturbances. To face squarely the problems involved requires more courage than some can muster. These blunder along through life, frequently escaping disaster through chance. Others when confronted with the facts develop an unwholesome fear and establish at once a procedure in hygiene and sanitation that is marked with absurd antiseptic measures or is characterized by extension of their symptoms due to the mental distress. Somewhere between these two extremes lies that golden mean that calculates life's hazards as the athlete measures the height of the obstacle to be surmounted. It all is part of the great game. The fact that the normal habitat of tetanus

is the intestinal tract of herbivora,[1] and that, therefore, the bacillus is found most frequently in stable yards, will not mean that horses and barns will be shunned, nor that puncture of the foot by a nail in a board in the barynard will be ignored. The rational life will recognize the facts of life and life processes; the courageous life will meet and face the facts. Prevention of disease will be considered by those who live fully, as an important means for rendering service. To avoid colds, to evade pneumonia, to escape Bright's disease are pathways not to Nirvana, but to that condition of physical superiority that is justified only by service and finds its fullest and best satisfaction in worthwhile work.

The prevention of disease resolves itself into what might be called general and specific means.

General Means of Prevention.—Resistance: It is a common observation that some persons when exposed to disease contract and develop the infection, while others do not. This freedom from disease by one exposed to it illustrates what science understands by the term "resistance." Resistance to disease may be racial, *e. g.*, the Jew and tuberculosis, and at times it seems to be an individual matter entirely. Resistance to disease in general may be developed. Healthful conditions of the body tissues and fluids renders the protective mechanism of the body more effective in its safeguarding activities. Resistance is developed through proper habits of living and is a result of correct adjustments of the body to the life of the environment. Resistance and health are in one sense synonymous. It is generally maintained that both flow from hygienic living. Resistance may not always protect from disease because at times an organism will be so virulent that the protective forces of the body are broken through. It represents, however, the first line of defense in all war on disease.

It is generally believed that fatigue lowers the resistance to disease. People speak of "catching cold" because they "got tired out." There seems to be some evidence from

[1] Park found tetanus bacilli in the excreta of about 15 per cent of horses and calves in the vicinity of New York City. They are present in other herbivora to a less extent.

experience for this general belief. Lee[1] refers to the claims of Sir James Paget that fatigue had a larger share in the promotion and transmission of disease than any other single causal condition. Abbott and Gildersleeve[2] observed that animals, fatigued by running, show a depression of the opsonic index, but the experiments of Oppenheimer and Spaeth[3] show quite the opposite. The latter experimenters found with white rats that fatigue increased resistance to toxins of both tetanus and pneumococcus. More recently Price-Jones[4] reports that under certain conditions fatigue does promote infection. Clearly with such conflicting reports the issue is not settled. Even after results on animals are fairly in agreement, the study of similar processes on man will have to be made.

Resistance is not the same as immunity, because immunity is specific. When pathologic organisms enter the body there is a reaction by the body to the invader. This reaction has been explained in several ways and these ways constitute the theories of immunity proposed as explanation of what happens. The theory of immune substances which act very much as chemicals do to neutralize the toxins of disease has been formulated chiefly by Ehrlich, and is known as the side-chain hypothesis. The theory of phagocytosis is associated largely with the name of Metchnikoff. Recently, a new theory has been formulated by d'Herelle as a result of his observations of patients with dysentery. This is the theory of immunity as illustrated by the action of the bacteriophage. These three theories will be considered below.

Ehrlich's Side-chain Hypothesis.—About forty years ago Traube showed that if a small quantity of putrefying material were added to fresh blood, the blood would possess the

[1] Lee, F. S.: The Human Machine, Longmans, Green & Co., New York, 1918.

[2] Abbott and Gildersleeve: The Influences of Muscular Fatigue and Alcohol on Certain of the Normal Defenses, *University of Pennsylvania Medical Bulletin*, 23: 169, 1910.

[3] Oppenheimer, E. H., and Spaeth, R. A.: *American Journal of Hygiene*, January, 1922, p. 51.

[4] Price-Jones, C.: Experiments on the Influence of Fatigue on Infection, *Journal of Pathology and Bacteriology*, January, 1926.

power of retaining its normal condition. This experiment raised the question whether the protective power of the blood resided in the plasma or in the blood cells.

It is a well-known fact that persons are protected from recurring attacks of a disease once experienced. Most of the communicable diseases, scarlet fever, measles, smallpox

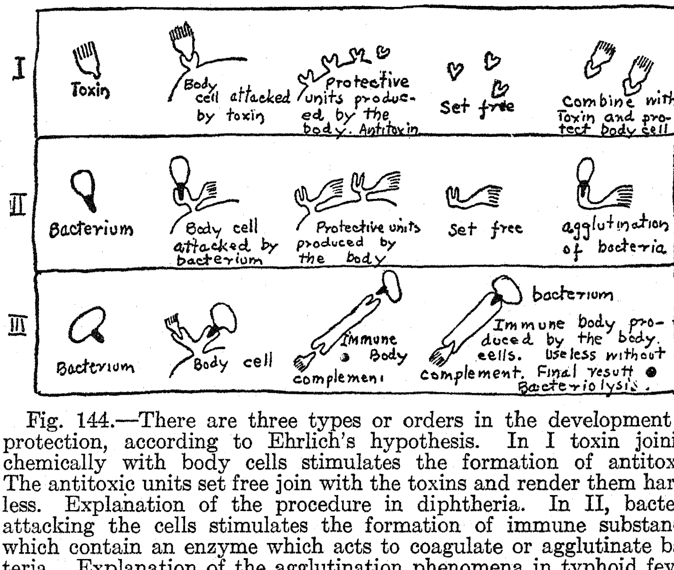

Fig. 144.—There are three types or orders in the development of protection, according to Ehrlich's hypothesis. In I toxin joining chemically with body cells stimulates the formation of antitoxin. The antitoxic units set free join with the toxins and render them harmless. Explanation of the procedure in diphtheria. In II, bacteria attacking the cells stimulates the formation of immune substances which contain an enzyme which acts to coagulate or agglutinate bacteria. Explanation of the agglutination phenomena in typhoid fever. In III bacteria attacking the cells stimulates the formation of immune substances which require the presence of a substance free in the blood known as complement. When complement is present and joins with the immune substance, the bacterium is destroyed. Phenomenon known as bacteriolysis. The same phenomenon is utilized in the hemolysis of red blood cells by the use of a foreign protein. (After Aschoff.)

and typhoid, are, as a rule, capable of infecting the same individual only once.

The protection afforded to the individual by an attack of a disease is called "immunity," and is due in part to certain substances developed in the blood in the course of the disease and called by the name immune bodies or antibodies.

By this is meant that these substances have the power of exerting adverse action against the invading bacteria.

There is, then, normal serum containing general protective agents, and immune serum containing specific defenders against specific diseases. This Vaughan makes clear when he says: "The essential difference between the germicidal constituent of normal serum and that of immune serum is that the latter is specific, while the former is not." Normal serum may be made immune by inoculation or vaccination for certain diseases, *e. g.*, smallpox, typhoid, etc., and this immunity according to Ehrlich's hypothesis is secured by the production of immune bodies stimulated by the vaccination.

These phenomena that have been described are interpreted by Ehrlich as representing chemical changes in the blood that can be graphically portrayed according to the illustration in Fig. 144.

Metchnikoff's Theory of Phagocytosis.—Metchnikoff was the first to emphasize the importance of the blood cells, and he showed how the white cells of the blood swallowed and destroyed bacteria. The phagocyte is not always able to win the fight with the bacteria, and if weakened by unhygienic living or disease, or attacked by bacteria either more powerful or more numerous than usual, the phagocytes themselves may be overcome in the contest.

D'Herelle's Bacteriophage.—During the study of a patient with dysentery d'Herelle noticed that one of the tubes of fecal material and bouillon which had been incubated in the usual manner, showed no growth and on close examination was actually sterile. One of these sterile tubes was subsequently inoculated with the Shiga bacillus and after incubation it, too, became sterile. Thus it appeared that in the course of the disease, there came a time when some substance, developed in the intestinal tract, had the power to destroy pathologic organisms. D'Herelle states that this phenomenon is true for other organisms also, and mentions *Bacillus typhosus, Bacillus diphtheriae,* and others.

D'Herelle suggests that the bacteriophage makes the phagocytic action of the leukocytes stronger and more effective. It is of course possible that he has described the

details of immunity in certain diseases for which Metchnikoff's and Ehrlich's explanations will still suffice. On the other hand, d'Herelle maintains[1] that the bacteriophage is "a living, ultramicroscopic being" that "dissolves bacteria through the agency of a ferment which it secretes." This view injects a new factor into the question of immunity and makes the bacteriophage a real virus, a "parasite of bacteria."

Special Means of Prevention.—Artificial immunity: It is known that immunity may be conferred artificially, and so there has developed, markedly in recent years, definite procedures in serum and vaccine prophylaxis to prevent disease by giving the individual an artificial immunity.[2] Notable achievements in this direction have been vaccination for smallpox, inoculation for typhoid, and antitoxin and toxin-antitoxin[3] for diphtheria.

Isolation and Quarantine.—The term "quarantine" arose in the practice of holding ships in port forty days when suspected of plague and not permitting intercourse with the land. Today, the term is defined to correspond with the scope of recent practice (see p. 490). The associated term "isolation" has also been defined by the Committee on Standard Regulations of the American Public Health Association.[4]

The Health Officer of a community is empowered to put into operation measures of isolation and quarantine. The Federal government has power of quarantine over interstate commerce and quarantine of ships entering ports of the United States. Officials of the United States Public Health Service detailed to important foreign ports from which vessels clear for the United States perform important services in this connection.

[1] D'Herelle, F.: Bacteriophage as a treatment in acute medical and surgical infections. *Bulletin of the New York Academy of Medicine*, May, 1931, pp. 329–348.

[2] Rosenau, M. J.: Preventive Medicine and Hygiene, D. Appleton & Co., New York, 1913, pp. 966–1034.

[3] Toxin-antitoxin is given to individuals who are susceptible to diphtheria, as shown by the Schick test.

[4] The Control of Communicable Diseases. Report of the Subcommittee on Communicable Disease Control of the Committee on Research and Standards, 1935.

Social Control of Sources of Infection.—It has been stated that there are several factors of importance in the prevention of transmission of disease. It is essential for purposes of disease prevention to control the liberty of action of the communicable sick, and the carriers of disease. For these reasons persons may be detained in quarantine or isolation, and objects or animals that may transmit disease are subject to control by the public health officials in charge of the administration of the sanitary law.

In recent years the effort to control communicable disease has resulted in enlarging the scope of the public health powers so that most of the communicable diseases must be reported to health departments by attending physicians. The list of reportable diseases varies in different states.

In addition to these measures, society empowers boards of health to set up and administer certain standards regarding the sanitary condition of foods, milk and water supplies. School children, workers in factories, dwellers in tenements, and other groups must submit to the control of their environment by experts employed by the state for the welfare of the entire people.

Prevention of Communicable Disease.[1]—The following data[2] on the control of communicable diseases are from the report of the American Public Health Association Committee on Standard Regulations and are reprinted with the permission of the Association.

The committee adopted the following definitions of terms:

1. *Carrier.*—A person who, without symptoms of a communicable disease, harbors and disseminates the specific micro-organisms. As distinct from a carrier, the term "infected person" is used to mean a person in whose tissues the etiological agent of a communicable disease is lodged and produces symptoms.

2. *Cleaning.*—This term signifies the removal by scrubbing and washing, as with hot water, soap, and washing soda, of organic matter on which and in which bacteria may find favorable conditions for pro-

[1] Tuberculosis has been discussed in Chapter VIII, and the venereal diseases in Chapter XIII.

[2] The entire report is not printed. Sections dealing with certain diseases quite infrequent in the United States have been omitted, namely, cholera, dengue, leprosy, plague, and Rocky Mountain spotted fever. Detailed data on the communicable diseases included are in the Appendix, pp. 537–595.

longing life and virulence; also the removal by the same means of bacteria adherent to surfaces.

3. *Contact.*—A "contact" is any person or animal known to have been sufficiently near to a human infected person or animal to have been presumably exposed to transfer of infectious material directly, or by articles freshly soiled with such material.

4. *Delousing.*—By delousing is meant the process by which a person and his personal apparel are treated so that neither the adults nor the eggs of *Pediculus corporis* or *Pediculus capitis* survive.

5. *Disinfection.*—By this is meant the destroying of the vitality of pathogenic micro-organisms by chemical or physical means.

When the word *concurrent* is used as qualifying disinfection, it indicates the application of disinfection immediately after the discharge of infectious material from the body of an infected person, or after the soiling of articles with such infectious discharges, all personal contacts with such discharges or articles being prevented prior to their disinfection.

When the word *terminal* is used as qualifying disinfection, it indicates the process of rendering the personal clothing and immediate physical environment of the patient free from the possibliity of conveying the infection to others, at the time when the patient is no longer a source of infection.

6. *Disinfesting.*—By disinfesting is meant any process, such as the use of dry or moist heat, gaseous agents, poisoned food, trapping, etc., by which insects and animals known to be capable of conveying or transmitting infection may be destroyed.

7. *Education in Personal Cleanliness.*—By this phrase is intended to include all the various means available to impress upon all members of the community, young and old, and especially when communicable disease is prevalent or during epidemics, by spoken and printed word, and by illustration and suggestion, the necessity of:

(1) Keeping the body clean by sufficiently frequent soap and water baths.

(2) Washing hands in soap and water after voiding bowels or bladder and always before eating.

(3) Keeping hands and unclean articles, or articles which have been used for toilet purposes by others, away from mouth, nose, eyes, ears, and genitalia.

(4) Avoiding the use of common or unclean eating, drinking, or toilet articles of any kind, such as towels, handkerchiefs, hairbrushes, drinking cups, pipes, etc.

(5) Avoiding close exposure of persons to the spray from the nose and mouth, as in coughing, sneezing, laughing, or talking.

8. *Fumigation.*—By fumigation is meant a process by which the destruction of insects, as mosquitoes and body lice, and animals, as rats, is accomplished by the employment of gaseous agents.

9. *Isolation.*[1]—By isolation is meant the separating of persons

[1] In view of the various ambiguous and inaccurate uses to which the words "isolation" and "quarantine" are not infrequently put, it has seemed best to adopt arbitrarily the word "isolation" as describing the limitation put upon the movements of the known sick or "carrier" individual or animal, and the word "quarantine" as describing the limitations put upon exposed or "contact" individuals.

suffering from a communicable disease, or carriers of the infecting micro-organism from other persons, in such places and under such conditions as will prevent the direct or indirect conveyance of the infectious agent to susceptible persons.

10. *Quarantine.*[1]—By quarantine is meant the limitation of freedom of movement of persons or animals who have been exposed to communicable disease for a period of time equal to the longest usual incubation period of the disease to which they have been exposed.

It is still considered necessary to require strict isolation of the patient for the period of communicability, and quarantine or immunization of contacts in certain diseases, notably smallpox. However, in some other diseases, such as poliomyelitis and encephalitis, isolation of the patient has but little apparent effect in limiting the spread of the disease, and the period of communicability is not known with reasonable accuracy in any given case.

Case-to-case infection is relatively infrequent in these latter two diseases; and yet the patient must be regarded as a potential source of infection and suitable precautions must be taken, even if these barriers to transmission of the disease are but partially effective. Uncertainty as to the exact duration of the period of communicability does not justify neglect of reasonable isolation measures but rather adds to our obligation to educate patients, the family, and the attending physician in the advantages to be had from separating the sick from the well, and in taking precautionary measures voluntarily when the presence of a communicable disease is suspected and before a diagnosis is established, after the official period of isolation is past, and generally during the epidemic prevalence of such diseases in the community.

The five specific objectives of personal cleanliness as defined above (7), if conscientiously attempted, will materially aid in reducing the amount and frequency of infection.

Isolation of a communicable disease from visitors is often of benefit to the patient as well as a protection to others; quiet, freedom from the excitement and fatigue of visits, and complete rest are important factors in the medical and nursing management of such patients and directly contribute to recovery.

11. *Renovation.*—By renovation is meant, in addition to cleansing, such treatment of the walls, floors, and ceilings of rooms or houses as may be necessary to place the premises in a satisfactory sanitary condition.

12. *Report of a Disease.*—By report of a disease is meant the notification to the Health Department and, in the case of communicable disease in animals, also to the respective Department of Agriculture which has immediate jurisdiction, that a case of communicable disease exists or is suspected of existing in a specified person or animal at a given address.

Each administrative health jurisdiction will ordinarily determine

[1] When the term "isolation" is used in connection with such diseases as the "common cold," influenza, chickenpox and mumps, it is not to be understood that the establishment of isolation is under ordinary circumstances a necessary or practicable procedure for official requirement or enforcement, but a practice to be instituted under the direction of the attending physician, and its duration to be generally, if not exclusively, at his discretion.

what diseases should be reportable, according to their prevalence, or their practical importance from the points of view of the administrator, the epidemiologist and the statistician. It is expected that local or state regulation will require the reporting of any unusual or group expression of illness which may be of public concern whether or not known or suspected of being communicable in nature, regardless of its inclusion in the lists.

13. *Susceptible.*—A "susceptible" is a person or animal who is not known to have become immune to the particular disease in question by natural or artificial process.

14. *Virus, Filtrable.*—The term "filtrable virus" as defining the etiological agent of certain diseases is used in the sense of a causal agent differentiated from other kinds of infectious agents such as bacteria, protozoa, etc. Many of these filtrable viruses can be grown *in vitro* in the presence of living susceptible cells, and such cultures will produce regularly typical diseases in animals and in man. The term "filtrable virus" has a significance comparable to that of bacterium, spirochete, or protozoon. The term "filtrable virus" is as definite a description of an etiological agent as is the statement that the typhoid bacillus causes typhoid fever. The idea conveyed by the statement that a filtrable virus is the etiological agent is that the cause of this disease is known, even though present knowledge does not permit further precision in distinguishing among filtrable viruses except by reference to the name of the disease produced by each.

Prevention of Nutritional Disease.—The facts concerning nutritional diseases have been increasingly revealed through the researches on vitamins and mineral salts in food. In addition to the recognition that definite clinical diseases, such as rickets, beriberi, scurvy, and diabetes,[1] are deficiency diseases, it is now known that a wide variety of health disturbances are due to lack of vitamins, mineral salts, or autacoids.

Deficiency in the diet of various vitamins brings a remarkable series of changes affecting many organs and functions. The chief disturbances that follow are not to be interpreted as due *solely* to vitamin deficiency; the evidence is not conclusive. Rather it should be understood that a relationship has been observed between the disturbances noted and vitamin deficiency. The health disturbances associated with deficiency in vitamin A are: pus infections, sinusitis, colds, night blindness, corneal ulcer, xerophthalmia, stone in kidney, rough dry skin, acne, respiratory tract infections, cystitis, and retarded sex functions.

[1] This is due to deficiency in pancreatic secretion, not to vitamin lack.

Health disturbances associated with vitamin B deficiency are: anemia, various nervous disorders, pancreatic insufficiency, loss of muscular tone, dry scaly skin, slow heart, poor lactation, peptic ulcer, poor appetite, and constipation.

Health disturbances associated with vitamin C deficiency are: cataract of the eye, decay of teeth, spongy gums, anemia, nerve lesions in scurvy cases, pallor, skin disturbances, rapid heart, gastric ulcer, easy fracture of bones, and pains in joints.

Health disturbances associated with vitamin D deficiency are: decay of teeth, lowered calcium and phosphorus in the blood, convulsions in severe cases (rickets), weakness of muscle, lowered resistance against tuberculosis, and improper bone formation.

Health disturbances associated with vitamin E deficiency are: impaired mental activity, weakness and atrophy of muscle, miscarriage, sterility in male and female, and frigidity.

Health disturbances associated with vitamin G deficiency are: conjunctivitis, receding and bleeding gums, anemia, weakness, skin lesions, dulness and loss of hair, digestive disturbances, and diarrhea.

The following specific nutritional diseases are related to deficiencies either in diet or internal secretions.

1. Rickets.—(*a*) Cause of the Disease.—The cause of rickets is inability of the organism to metabolize calcium and phosphorus. This is dependent upon vitamin D in the diet which may readily be supplied by cod liver oil, or upon plenty of sunlight, or probably upon secretions from the parathyroids. There is a varying susceptibility to the disease.

(*b*) *Prevention.*—The easiest prevention in the light of the known factors is exposure to sunlight,[1] or the addition of cod liver oil to the diet. The oil used should be as pure a product as possible.

2. Scurvy (scorbutus).—(*a*) Cause of the disease is the absence in the diet of vitamin C in sufficient quantities.

(*b*) *Prevention.*—Oranges, lemons, and canned tomato juice are efficient antiscorbutics. Raw fruits, vegetables, and salads will supply sufficient vitamin C if used regularly throughout the year.

[1] Sunlight will cure the disease, as shown by Hess and McCollum. Hess, A. F.: *Journal of Biological Chemistry*, January, 1922, p. 77; McCollum, E. V.: *American Journal of Diseases of Children*, February, 1922, p. 91. See also *Journal American Medical Association*, June 23, 1923, p. 1853.

3. PELLAGRA.[1]—(*a*) Cause of the disease has now been assigned to deficiency in vitamin G. There is believed to be a relation between the disease and a vegetable diet (restricted in kind of vegetables and without meat).

(*b*) *Prevention.*—Prevention seems possible along dietary lines alone. Addition of meat and variety in cereals and vegetables prevents the disease. Recent studies confirm the fact that butter, fresh beef, and yeast prevent pellagra.

4. DIABETES.—(*a*) The cause of deficient secretion from the islands of the pancreas is unknown.[2] There is often an hereditary predisposition. Luxurious and sedentary living appear to be important factors. Associated in the production of the disease at times are disturbances in the nervous system, exophthalmic goiter, disease of the liver or pancreas.

(*b*) *Prevention.*—Individuals whose parents have had diabetes should

[1] Goldberger and Wheeler: The Experimental Production of Pellagra, *Bulletin 120*, Hygienic Laboratory, V. S. P. H. S., February, 1920. Wheeler, G. A.: Treatment and Prevention of Pellagra, *Journal American Medical Association*, April 1, 1922, p. 955. Goldberger, J., *et al.*: *Public Health Reports*, 41: 297, February 19, 1926. Goldberger, J., and Tanner, W. F.: *Public Health Reports*, 40: 58–80, January 9, 1925.

Studies by Siler, MacNeal, and Garrison (Progress Reports I, II, III, New York Post-Graduate Medical School and Hospital, 1913, 1914, 1917) indicate that diet plays no part in the disease, but Goldberger and his associates are supported in their position that the disease is due to faulty diet by studies of the Royal Army Medical Corps on a large group of Armenian refugees and Turkish prisoners of war. Recent comment in the Journal of the American Medical Association (August 10, 1929, p. 462) quite fully accepts Goldberger's view. Bliss suggests that the deficiency is iron. (*Science*, December 5, 1930.)

The one observation that has recurred consistently throughout the conflicting literature of pellagra is the curative and preventive value of milk, which is a good source of all the different nutritional factors that have seemed to be involved. In a contribution by Stiebeling and Munsell* from the United States Department of Agriculture, one finds evidence of pellagra preventive value in a number of articles of food which vary so widely in character as to suggest that they might be quite as satisfactorily interpreted in terms of a combination of nutritional factors as of any one alone; and Sherman and Derbigny† of Columbia University offer evidence that the adequacy of the protein intake has a significant bearing on the ability of experimental animals (in this case rats) to endure a shortage of vitamin G. In terms of the Goldberger hypothesis, this has an important possible bearing on the genesis of pellagra.

[2] This refers, of course, to real diabetes. Sugar in the urine does not always mean diabetes.

* Stiebeling, H. K., and Munsell, H. E.: Food Supply and Pellagra Incidence, *Journal American Medical Association*, December 17, 1932.

† Sherman, H. C., and Derbigny, I. A.: Studies in Vitamin G (B) with Special Reference to Protein Intake, *Journal Biological Chemistry*, 99: 165, 1932.

be exceedingly careful of sedentary living, diet, and general hygiene. Diet is most important. Restriction in quantity of food eaten and restriction especially of sugars are to be practiced. A semi-annual medical examination would be advisable.

Insulin, a discovery by a group of Canadian scientists, is valuable in the treatment of the disease. Repeated injections are necessary.

5. GOUT.—(*a*) Cause of the disease is the accumulation in the body of excess purine bases derived from the nucleoproteins of food.[1]

(*b*) *Prevention.*—

1. Moderation in eating, avoidance of alcohol, tea, coffee, and cocoa.
2. Elimination of meat and vegetables rich in nucleoproteins.
3. Outdoor exercise. Avoidance of sedentary life.

6. GOITER.—(*a*) Cause of the disease is well established in the simple goiter type and suggested in the exophthalmic. Other forms are not related to iodine deficiency.

(*b*) *Prevention.*—(*a*) Simple goiter can be prevented by the addition of sodium iodide to the diet.

7. CRETINISM AND MYXEDEMA.—(*a*) Cause of the disease is the deficiency in thyroid secretion in the child (cretinism) or in the adult (myxedema).

(*b*) *Prevention.*—The development of the disease with our present information cannot be prevented. The giving of thyroid extract in cretinism will stop the progress of the disease and restore the person practically to normal. The extract must be given for life.

8. OBESITY.—(*a*) Cause of the Disease.—In susceptible persons, eating too much food and lack of exercise. The pituitary is often at fault and at times the adrenals are responsible. It is often hereditary.

(*b*) *Prevention.*—

1. Exercise.
2. Reduction of fats and carbohydrates in the diet.

Prevention of Acute Poisoning.—A distinction is to be made between food infections and food poisoning. A food infection is due to the growth of micro-organisms. Rosenau and Weiss[2] affirm that students of the subject of food infections "now believe that practically all instances . . . are due to the *bacillus of Gärtner* (Bacillus enteritidis), which is taken as a type of a group of closely related organisms." Food infection is not common in America. There have been in recent years numerous cases of food poisoning. This disturbance is due to the *production of the growth* of bacterial life. The organism producing the toxin is the *Bacillus botulinus* (Fig. 145). It may grow in meat, sausage, and vegetables. It has been found in improperly canned vege-

[1] Predisposing factors are heredity, the male sex, and alcohol.

[2] Rosenau, M. J., and Weiss, P. D.: Food Infections, *Journal American Medical Association*, December 17, 1921, p. 1948.

tables. Recently several deaths were caused by the eating of olives which had not been prepared properly, so that botulism developed. An excellent extended discussion of food poisoning is given by Rosenau.[1]

When wholesome food upsets an individual the cause is usually to be sought in the individual and not in the food. Present misconception tends to associate recently ingested food with present discomfort. Ulcer of the stomach is often the cause of many so-called "cases of food poisoning."

The acute poisons from meats or canned vegetables are to be prevented by better inspection in food industries, and by care in the selection and use of food products.

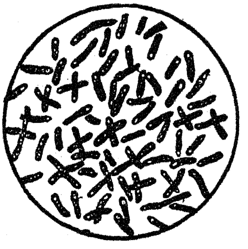

Fig. 145.—*Bacillus botulinus*, the cause of some cases of food poisoning. (Lehmann and Neumann.)

The poisons from lead and other metals can be avoided by protection of the worker in certain trades by means of masks and facial appliances, and by careful washing of the hands, especially painters, before eating.

Prevention of Chronic Disease of Middle Life.—Chronic diseases of middle life are seen particularly in the disturbances of the heart, the arteries, the kidneys, the nervous system, and diabetes.

The cause for the increase in these diseases has been attributed to the deterioration in systems due to wear and tear of strenuous modern life. Some suggest that the increase represents, in part at least, the salvage of poor biological material in infant welfare efforts. This hardly seems a sound view. It is far more justified by the lack of proper

[1] Rosenau, M. J.: Preventive Medicine and Hygiene, pp. 538–570.

development of organic viscera in childhood due to the totally inadequate physical education program in the schools. There may be many other causes, such as chronic pus infections, that help to explain the problem.

There is, therefore, little precise information available regarding prevention. The *periodic health examination,* however, constitutes the single most important measure, for through this, early signs of disease give a direct clue to errors that may be corrected. Personal hygiene in all its manifold aspects remains as the one corrective agent. Education must increasingly pay attention to instruction in how to live.

Prevention of Functional Disease:

1. Neurasthenia.
   (*a*) **Cause of the disease** is complex. Hereditary predisposition plays an important part. Upon hereditary weakness the stresses and strains of life at times bear too heavily. With such overload the individual frequently develops bodily complaints that have little or no organic basis.

   The common active causes of breakdowns are mental and physical overstrain, worry, sexual disorders, poisons, such as morphine, tobacco, or alcohol, and the poisons from typhoid, malaria, influenza, and syphilis.

   (*b*) **Prevention.**

   The prevention relates directly to the cause of the disease. Cabot has many helpful suggestions in his book, "What Men Live By." See also Paton's "Human Behavior."
2. Hysteria.
   (*a*) **Cause of the disease** is complex. Heredity is a most important factor in its causation. Charcot held that every case was based on bad heredity. Exciting causes are mental or emotional shock, long-continued anxiety or care, worry, and mental strain. In some cases sexual worries or disturbances may induce the disease.

   (*b*) **Prevention.**

   On the basis of psychology prevention must be based on educational lines.
   1. Education must seek to inculcate habits of self-control.
   2. Whims and desires are to be gratified only on a rational basis of worth.
   3. Sympathy must not be too lavish. Trifling hurts and sorrows are not to be made the occasion for excessive sympathy. The treatment of girl children must be made similar to the treatment of boys in this respect. Self-reliance and self-control are as important for girls as for boys.[1]

[1] Williams, J. F.: Values of Camping for Girls, *Teachers College Record,* January, 1920.

4. Out-of-door activities with development of interests in sports, games, and friends must replace the day-dreaming and romantic, erotic coloring of the usual social life of the girl at the beginning of adolescence.
5. The hereditary factor is a eugenic problem.

Prevention of the Local Infections:[1]

(*a*) **Causes of the infections** are a number of disease-producing organisms that enter through a break in the skin or mucous membranes. (See Chapter XV for focal infections.)

(*b*) **Prevention.**

Prevention resolves itself into three factors:

1. Keeping the general resistance as high as possible.
2. Avoiding skin and mucous membrane injuries.
3. Careful treatment of all wounds and injuries. (See Chapter XV for focal infections.)

Prevention of Cancer: Cells grow to a certain size and shape normally and parts of the body likewise observe a normal range within which growth occurs. Why growth stops is not known; apparently some laws are being obeyed of which science is uninformed. At times some cells begin to grow lawlessly, without regard for normal limits. These are cancer cells (Fig. 146). They invade surrounding tissue and extend into the blood stream and lymphatics, in which case they may be carried to distant parts. Thus, cancer of the breast may extend to the arm, neck, or lungs; and cancer of the stomach may readily travel to the liver.

There are more recorded cases of cancer every year. In New York City this condition is clearly shown. It is not clear that cancer is actually increasing, but it is such a serious disease that every effort should be taken to decrease its ravages. The following statement of the facts and opinions agreed to by the International Meeting on Cancer Control held at Lake Mohonk, New York, September 20–24, 1926, gives a summary of the situation as regards cause, diagnosis, treatment and prevention of this disease. It is repro-

[1] There are several infections that are localized in the body but because of their general effects are not regarded usually as local infections. Acute appendicitis is an illustration. The cause of the condition is not known although the vestigial character of the appendix, the presence of infection elsewhere in the body, or foreign bodies in the appendix are given as causes. Often a real appendicitis is erroneously regarded as a "stomach ache." To use a cathartic in appendicitis is a serious mistake.

duced here by permission of The American Society for the Control of Cancer.

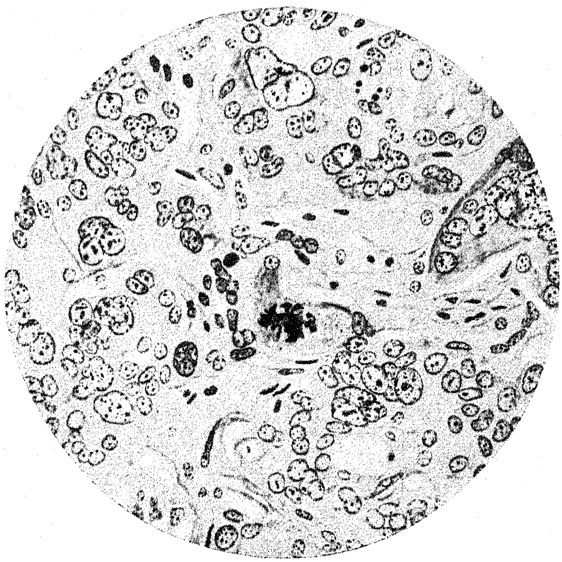

Fig. 146.—Epithelioma of cervix uteri with many multinucleated cells. In the center there is an epithelial cell showing multipolar mitosis. (MacCallum.)

Although the present state of knowledge of cancer is not sufficient to permit of the formulation of such procedures for the suppression of this malady as have been successfully employed for the control of infectious diseases, there is enough well-established fact and sound working opinion concerning the prevention, diagnosis, and treatment of cancer to save many lives, if this information is carried properly into effect.

1. The causation of cancer is not completely understood, but it may be accepted that for all practical purposes cancer is not to be looked upon as contagious or infectious.

2. Cancer itself is not hereditary, although a certain predisposition or susceptibility to cancer is apparently transmissible through inheritance. This does not signify that, because one's parent or parents or other members of the family have suffered from cancer, cancer will necessarily appear in other persons of the same or succeeding generation.[1]

[1] The *Journal of the American Medical Association* (May 7, 1932, p. 1656) notes in an editorial as follows:

"At the present time it seems safe to maintain that the existence of

3. The control of cancer, so far as this subject can be understood at the present time, depends upon the employment of measures of personal hygiene and certain preventive and curative measures, the success of which depends upon the intelligent co-operation of the patient and physician.

4. Persons who have cancer must apply to competent physicians at a sufficiently early stage in the disease, in order to have a fair chance of cure. This applies to all forms of cancer. In some forms early treatment affords the only possibility of cure.

5. Cancer in some parts of the body can be discovered in a very early stage, and if these cases are treated properly the prospect for a permanent cure is good.

6. The cure of cancer depends upon discovering the growth before it has done irreparable injury to a vital part of the body and before it has spread to other parts. Therefore, efforts should be made to improve the methods of diagnosis in these various locations and the treatment of the cancers so discovered.

7. The public must be taught the earliest danger signals of cancer which can be recognized by persons without a special knowledge of the subject, and induced to seek competent medical attention when any of these indications are believed to be present.

8. Practitioners of medicine must keep abreast of the latest advances in the knowledge of cancer in order to diagnose as many as possible of the cases of cancer which come to them.

9. Surgeons and radiologists must make constant progress in the refined methods of technic which are necessary for the diagnosis and proper treatment not only of ordinary cases, but of the more obscure and difficult ones.

10. There is much that medical men can do in the prevention of cancer, in the detection of early cases, in the referring of patients to institutions and physicians who can make the proper diagnosis and apply proper treatment, when the physicians themselves are unable to accomplish these results. The more efficient the family doctor is, the more ready he is to share responsibility with a specialist.

11. Dentists can help in the control of cancer by informing themselves about the advances in the knowledge of the causes of cancer,

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an hereditary influence on the susceptibility and resistance to cancer has been established both for man and animals. The exact mechanism of the hereditary influence has yet to be determined. The evidence offered by human material is conflicting, and inadequate both in amount and character to permit of satisfactory analysis. The studies so far made with spontaneous tumors occurring in laboratory animals show the possibility of modifying the occurrence of cancer in these animals in marked degree, and of determining by experimental genetics the site and character of the tumors that will arise. Therefore, we may reasonably look forward to the eventual finding of a definite explanation of the genetic mechanism which determines susceptibility and resistance to human cancer."

The Berlin statisticians G. Wolff and A. Jahn have established by an exhaustive inquiry that no influence of wealth or social position on the level of cancer mortality can be demonstrated. *Journal American Medical Association,* Berlin Foreign Letters, June 17, 1933, p. 1948.

especially with relation to the irritations produced by imperfect teeth and improperly fitting dental plates. They can also help by referring cases of cancer which they discover to physicians skilled in the treatment of cancer in this location. It may be doubted whether all dentists fully realize the help which can be obtained from x-ray photographs in revealing not only the state of the teeth, but the condition of the bone surrounding them.

12. Medical students should be instructed in cancer by the aid of actual demonstrations of cancer patients, and this to a sufficient extent to give them a good working knowledge of the subject.

13. The most reliable forms of treatment, and, in fact, the only ones thus far justified by experience and observation, depend upon surgery, radium, and x-rays.

14. Emphasis should be placed upon the value of the dissemination of the definite, useful and practical knowledge about cancer, and this knowledge should not be confused nor hidden by what is merely theoretical and experimental.

15. Efforts toward the control of cancer should be made in two principal directions: (1) The promotion of research in order to increase the existing knowledge of the subject, and (2) the practical employment of the information which is at hand. Even with our present knowledge many lives could be saved which are sacrified by unnecessary delay.

What Are the Chances?—Disease results in recovery or death. The recovery may be complete or the disease may leave the individual impaired for months, years, or the entire lifetime. There is great diversity in the effects produced. Some diseases attack a single organ, while others are characterized by general effects upon the body. A simple disease like chickenpox is recovered from always. Measles, mumps, malaria, gout, depend greatly upon the patient and the treatment to foretell the outcome. Such serious disturbances as endocarditis, and poliomyelitis (infantile paralysis), invariably produce some permanent injury; tuberculous meningitis and leukemia (a disease of the blood) are always fatal. While the prognosis can be stated with assurance in many instances, there are so many variables in others that an exact prophesy is impossible. It may be said, therefore, that the outcome of any disease is dependent upon the nature of the disease itself; upon such personal factors as age, habits, sex, race, heredity, and resistance; upon such environmental factors as economic strains, social surroundings, and sanitary standards; and upon the judgment and skill of physician and nurse. The course of different dis-

eases is fairly well known, and the following statement of prognosis should be helpful in estimating the seriousness of different diseases:

1. *Diseases from which recovery is possible:*
   - (*a*) Complete cure possible:
     1. Mild intoxications, such as food poisoning.
     2. Mild mechanical and chemical injury.
   - (*b*) Complete cure probable:
     1. Chickenpox (varicella).
     2. Dengue.
     3. German measles (rubella).
   - (*c*) Recovery probable, but dependent upon patient and treatment:
     1. Measles.
     2. Erysipelas.
     3. Mumps.
     4. Early tuberculosis.
     5. Diabetes.

     In this group a complication may be fatal.
   - (*d*) Recovery probable in the majority of cases:
     1. Serious infections, such as pneumonia, give a guarded prognosis.
     2. Trichinosis, scarlet fever, typhoid, yellow fever.
2. *Diseases in which recovery from acute attack is probable, but some chronic injury is likely to remain:*
   1. Endocarditis (heart disease).
   2. Infantile paralysis (poliomyelitis).
   3. Acute rheumatic fever.
   4. Nephritis.
   5. Arteriosclerosis.

   Nephritis may not and arteriosclerosis does not show an acute form. Injury to kidneys or arteries is usually permanent.
3. *Diseases in which recovery is rare:*
   1. Hydrophobia.
   2. Tetanus.
   3. Sepsis.
   4. Anthrax.

   The mortality in this group is over 80 per cent unless a special curative agent is used early. Hydrophobia and tetanus will show a good prognosis under early Pasteur treatment for the former and early antitetanus serum for the latter.
4. *Diseases in which recovery is not sure:*
   1. Malaria.
   2. Secondary syphilis.
   3. Epidemic meningitis.
   4. Gout.
   5. Chronic tuberculosis.
   6. Tertiary syphilis.

5. *Diseases from which complete recovery is impossible:*
    1. Purulent meningitis.
    2. Acute leukemia.
    3. Acute septic endocarditis (except the gonococcus form).

    Slowly fatal types are:

    4. Chronic leukemia.
    5. Addison's disease.
    6. Carcinomata (cancer) of internal organs (some exceptions).
    7. Endocarditis (Streptococcus viridans type).
6. *Diseases in which a functional cure may be secured by the surgeon:*
    1. Renal calculus (stone in the kidneys).
    2. Cholelithiasis (gallbladder disease).
    3. Internal suppurations.
    4. Malignant growth that has an early diagnosis and complete removal.

Summary.—The causes of disease are bacterial, protozoan, and at times metazoan. In addition, poisons from food or drink, or imperfect metabolism of food in the body may produce disease. The maladjustments of the individual to life's problems may result in functional disturbances and failure of endocrine organs to function properly may bring on serious disorders.

The carriers of disease of the communicable kind are either persons suffering in mild form from disease, such as colds, measles, etc., or "carriers" in whom the organism grows and develops without producing the symptoms of the disease. The "carrier" is well recognized in typhoid and diphtheria. In addition, objects may carry disease, although they are held now to be less dangerous than they were thought to be formerly. Nevertheless, infectious material on objects may be transmitted to well persons. Flies, rats, bedbugs, lice, fleas, cows, dogs, cats, and other animals, may carry certain infectious agents to man. Typhoid, plague, typhus, tuberculosis, diphtheria, and many other serious diseases may be transmitted by means of insect or other animal carriers.

The defenses against germ disease are the forces of resistance developed in the body naturally and the artificial immunities which may be conferred by vaccination and serum treatment. In constant warfare against many transmissible disease agents are sunlight and air. Thus the environment

offers forces of tremendous value to man in combating disease. Organized society has erected administrative defenses in the form of isolation and quarantine which are indeed helpful.

To eliminate causes, to control "carriers," and to build up defenses are the three legs of the tripod—Disease Prevention. To do this, hygiene in all its aspects is immensely valuable.

ACCIDENTAL DEATHS

Cause of death.	Deaths and death rates in the registration area in continental United States (exclusive of Utah).					
	Number of deaths.			Rate per 100,000 estimated population.		
	1932	1931	1930	1932	1931	1930
Accidents in mines and quarries	1,503	1,828	2,488	1.3	1.5	2.1
Accidents from agricultural machinery	283	311	313	0.2	0.3	0.3
Elevator accidents	216	285	345	0.2	0.2	0.3
Accidents from machinery used for recreation	13	16	16	[1]	[1]	[1]
Other machinery accidents	874	1,012	1,383	0.7	0.9	1.2
Railroad and automobile collisions	1,462	1,645	1,753	1.2	1.4	1.5
Other railroad accidents	3,490	3,574	3,994	2.9	3.0	3.4
Street car and automobile collisions	302	419	460	0.3	0.4	0.4
Other street car accidents	521	674	710	0.4	0.6	0.6
Automobile accidents (primary)	26,235	29,885	28,950	21.9	25.1	24.5
Motorcycle accidents	241	315	374	0.2	0.3	0.3
Other land transportation accidents	1,115	1,167	1,066	0.9	1.0	0.9
Water transportation accidents	1,116	813	716	0.9	0.7	0.6
Air transportation accidents	384	487	593	0.3	0.4	0.5

[1] Less than one-tenth of 1 per 100,000 population.

In this connection, mention should be made of the loss of life due to accidents. While accidental deaths due to falls, drowning, fire, poisoning and miscellaneous causes remain about the same, there is a definite increase in the towns and cities of deaths due to crushing by vehicles. These are mainly automobiles. The increase in deaths from crushing by vehicles is most marked. This is typical of the record of most large cities.

The data reported by the Department of Commerce and given in the table above are of interest.

QUESTIONS AND EXERCISES

1. State your attitude toward the necessity of disease. Justify your attitude.
2. List reasons for infant mortality reduction.
3. List the different types of diseases.
4. State causes of communicable diseases; of nutritional diseases; of acute poisons; of chronic diseases of middle life; of functional disease; of local infections; of cancer and tumor.
5. How are bacteria transmitted?
6. State the hygienic point of view with reference to the prevention of disease.
7. State specifically how resistance may be developed.
8. Contrast resistance with immunity.
9. State the relation of fatigue to resistance.
10. Describe Ehrlich's theory of immunity.
11. Describe Metchnikoff's theory of phagocytosis.
12. State d'Herelle's theory of a bacteriophage.
13. Discuss artificial immunity.
14. Describe isolation, quarantine, disinfection, fumigation.
15. Describe diphtheria giving the name of the infectious agent, sources of infection, mode of transmission, incubation period, period of communicability, and methods of control.
16. State preventive measures for rickets, scurvy, pellagra, gout, goiter, and cretinism.
17. Distinguish between food infections and food poisoning.
18. To what degree may the periodic health examination be expected to control the progress of the chronic disease of middle life?
19. List the chief points in prevention of functional disease.
20. List the important preventive measures recommended by the American Society for the Control of Cancer.
21. Upon what does the outcome of a particular disease depend?

CHAPTER XV

HYGIENE OF THE MOUTH, EYE, AND EAR

I. Anatomical and Physiological Backgrounds.

HYGIENE OF THE MOUTH, NOSE, AND SINUSES

I. Teeth:
- The Cause of Dental Defects.
- Teeth as Foci of Infection.
- Pyorrhea Alveolaris.
- How to Keep the Mouth and Teeth Clean.

II. Tonsils as Foci of Infection.
III. The Nose and Sinuses as Foci of Infection.
IV. Mouth Washes, Sprays, and Gargles.

HYGIENE OF THE EYE

I. The Eyes Need Care.
II. How to Care for the Eyes.
III. The Cause of Eye Defects or Disturbance.
IV. The Use of Drops and Other Treatment.
V. Common Disorders of the Eye.

HYGIENE OF THE EAR

I. The Ear Needs Care.
II. How to Care for the Ear.
III. The Mastoid.

Anatomical and Physiological Backgrounds.—Certain facts have been given regarding the sinuses and nasal passages. At this time the teeth and tonsils will be described and certain facts presented about the eye and ear.

The Anatomy of an Infection.—When bacteria gain entrance to the tissues, they grow and thrive unless checked by the forces of the circulation that oppose them. The resulting condition is called inflammation which is denoted by the *itis* ending of words describing disease, such as appendicitis, bronchitis, tonsillitis, rhinitis, cystitis, nephritis, etc. The character of the inflammation varies exceedingly according to the violence of the bacteria, the resistance

of the individual, and the kind of tissue involved. The resistance of the individual is expressed in terms of immune substances in the blood that check the growth of micro-organisms and of white blood cells that carry on active warfare against the foreign invaders. An area of infection will show increased blood supply to the part, accounting for the swelling, heat, and redness usually prevailing. In acute infections the leukocytes are greatly increased in the area, in chronic infections the lymphocytes predominate. In an

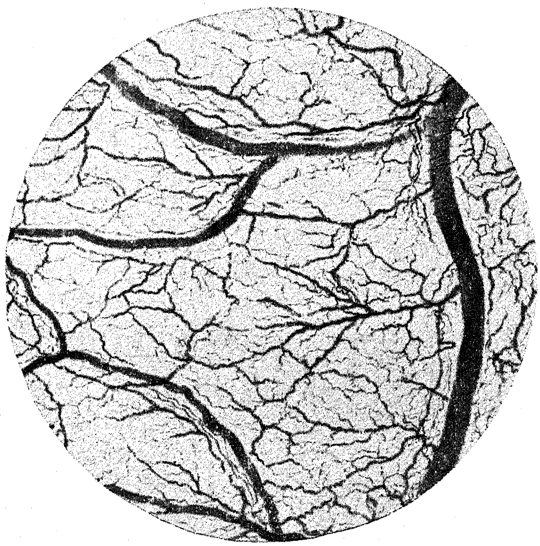


Fig. 147.—Portion of inflamed diaphragm cleared by Spalteholtz's method to show the abundant dilated blood channels. (MacCallum.)

acute infection with resulting inflammation there are four characteristic stages:

1. There is a dilatation of vessels and a slowing of the blood current. The quantity of blood in the part is increased (Fig. 147).
2. In the course of an hour the blood flow is slowed further, and the leukocytes in increasing numbers are arranged around the outer part of the blood stream,

the so-called "margination of the leukocytes" (Fig. 148).

3. Soon after the leukocytes begin to penetrate the walls of the blood vessels and reach the site of the irritation. These white cells engulf foreign particles and begin an active battle with bacteria present.
4. The leukocytes may completely overwhelm the bacteria; in such an event the inflammation at once subsides. If the bacteria are especially virulent or in a large number, the process is prolonged and many leukocytes are killed in the fight. The dead bodies of leukocytes and local cells killed in the contest form pus.

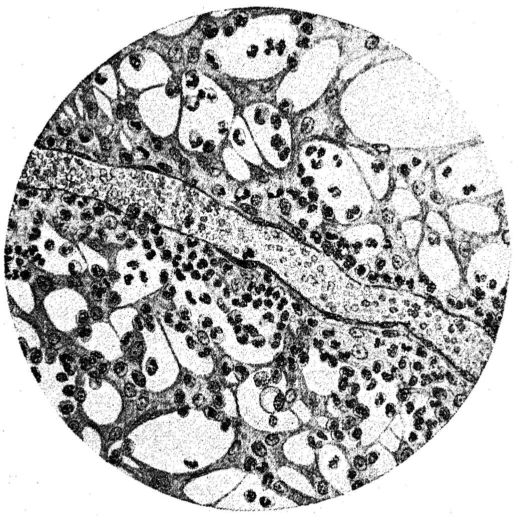


Fig. 148.—Inflamed omentum showing outwandered leukocytes about a small vessel. (MacCallum.)

The Tonsil.—Between two folds of tissues at the gateway from mouth to pharynx lie the tonsils, one on each side of the opening. The structure is composed of lymph gland tissue that has twelve to fifteen openings on the surface, called crypts. Apparently the tonsil is similar in function to lymph

glands but its removal works no hardship on the protective functions of the individual. Due to its exposure to the mouth cavity, bacteria can gain easy entrance; and hence inflammation of the tonsils is not uncommon. When acute the condition is called tonsillitis or sore throat. After

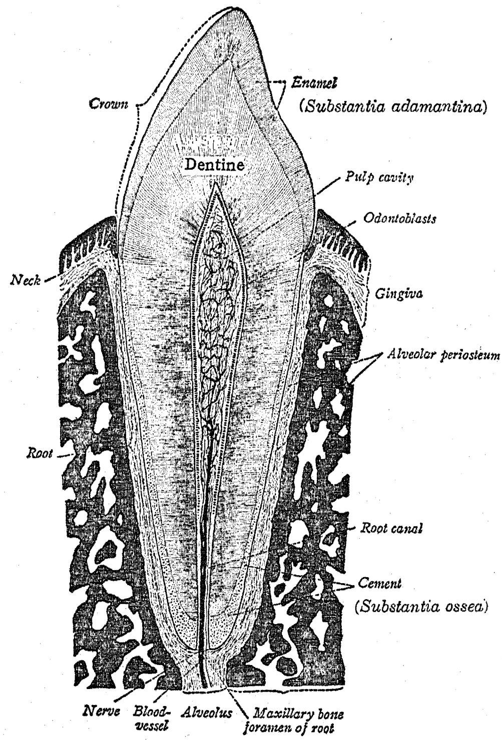


Fig. 149.—Longitudinal section of a tooth in its alveolus (diagrammatic). (Sobotta and McMurrich.)

repeated infections the tonsil is often enlarged. At times an infection is not entirely overcome and a center remains that contains bacteria which constantly give poisons to the blood. This is called a chronic focus of infection.

The Teeth.—A tooth is a hard structure composed of dentin that is covered by enamel (Fig. 149). Within the dentin

is a pulp cavity containing nerves and blood vessels. The tooth rests in a pocket of the jaw bone. Infection may start in the tooth through a break in the enamel. This is the typical caries of teeth. The process destroys a considerable portion of the tooth if not corrected. At times infection may enter at the base of the tooth and form a pocket of pus around the root. This may give an ulcerated tooth which is acute in its form, or it may remain a chronic focus that is only detected by the x-ray.

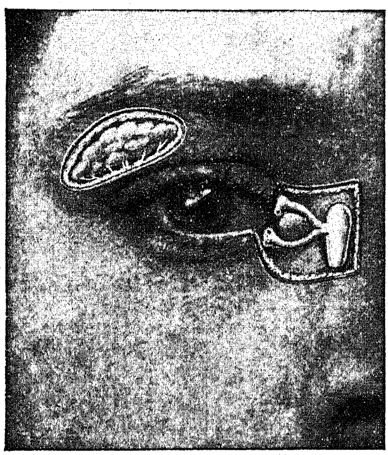


Fig. 150.—Lacrimal apparatus. (Campbell.)

The Eye.—The eye is the highly specialized receptor of the optic nerve. Its mechanism enables light waves to reach the optic nerve endings producing sight.

The outer parts of the eye comprise two lids that protect the eye. In the upper and outer segment of the eye opening is the lacrimal gland which secretes a fluid that washes the front of the eye. This secretion empties into ducts that flow into the nasal passage (Fig. 150). When the gland is highly stimulated, the secretion is produced faster than the ducts can carry it off, producing tears that flow over the brim of the lower lid.

The eye proper is a globular structure composed of three

coats and divided into two cavities (Fig. 151). The outer coat is a fibrous structure that gives form to the eyeball. In front this is somewhat modified to form the cornea. The middle coat is composed of blood vessels. The inner coat is composed of the endings of the optic nerve spread out in

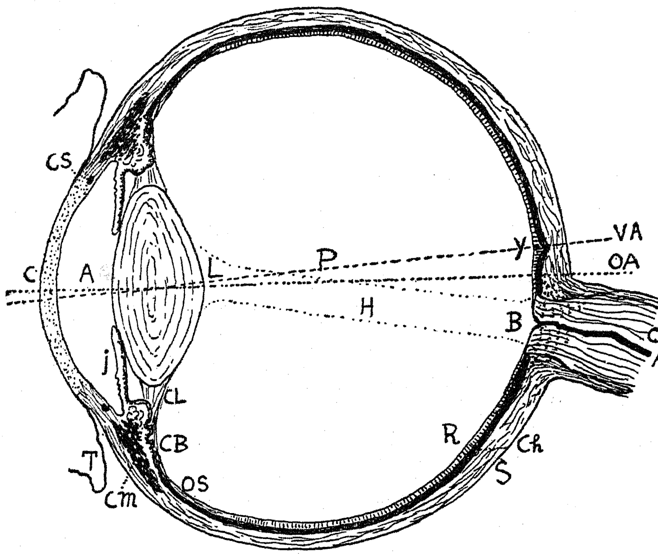


Fig. 151.—Diagram of a horizontal section through the human eye: *C*, Cornea; *A*, anterior cavity which includes part in front of iris, the anterior chamber, and part behind iris and in front of lens, the posterior chamber; *P*, posterior cavity; *L*, lens; *J*, iris; *T*, conjunctival sac; *CL*, ciliary ligament; *CB*, ciliary body; *CM*, ciliary muscle; *OS*, ora serrata; *CS*, canal of Schlemm; *R*, retina; *Ch*, choroid; *S*, sclera; *ON*, optic nerve; *Ar*, retinal artery; *B*, blind spot; *Y*, yellow spot; *OA*, optical axis; *VA*, visual axis; *H*, hyaloid canal. (Burton-Opitz.)

a layer that lines the inside of the rear half of the eye. This layer is the retina.

In the front part of the eyeball are some structures that separate the eye into the two chambers. Most conspicuous is a circular disk, the lens, that is slung from a support, the suspensory ligament that attaches peripherally to a muscle of the middle coat. Contraction or relaxation of this muscle

can change the shape of the lens which is quite elastic. In front of the lens is a diaphragm like a shutter on a camera, called the iris. This is composed of muscle cells and by contraction of certain fibers, the size of the opening can be changed.

The retina is a highly complex series of nerve cells (Fig. 152) that respond to light waves by producing nerve impulses. These pass over the optic nerve to reach the rear of the brain where sight really takes place. The eye is merely a receptor for picking up the rays, and its different parts comprise the arrangement that does this.

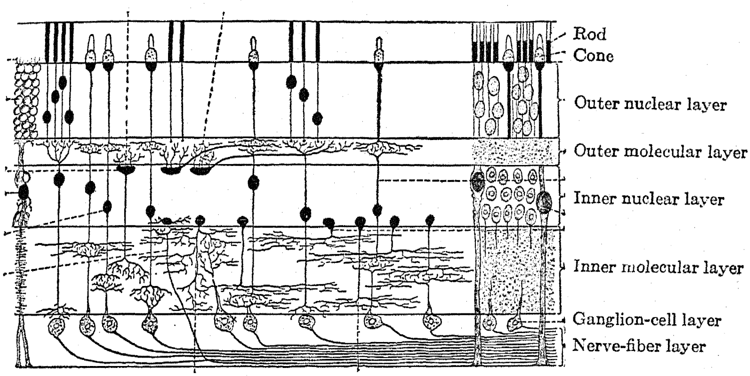


Fig. 152.—Schematic diagram of the retina according to Ramón y Cajal. Notice the great variety of cells in the different layers. (Böhm, Davidoff, and Huber.)

The Ear.—The ear (Fig. 153) is usually described in three parts, the external, middle, and internal ear. The external ear is a structure for directing sound waves into a canal to a drum membrane that marks the beginning of the middle ear. The canal is about 1 inch long; glands along its course secrete a brownish wax, called cerumen.

The middle ear is a small cavity in which are three tiny bones that provide transmission for the sound vibrations that move the drum membrane. The first one is attached to the drum and the last one fits into a small opening in the wall of the internal ear. The middle bone is articulated

between the two. From the middle ear cavity extend two important structures. One is a passage to the mastoid cells, a group of bone spaces in the mastoid bone situated behind the ear. The other is a tube, the eustachian tube, that extends downward to the pharynx. These two structures bear important health relationship. Infection from the pharynx may reach the middle ear and injure the hearing apparatus; it may extend to the mastoid cells producing mastoiditis, a very serious condition.

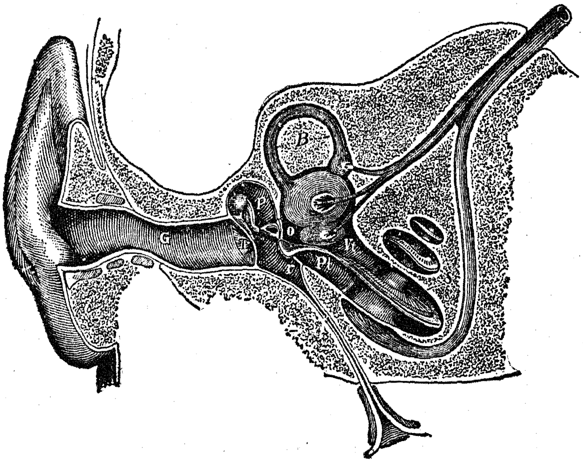


Fig. 153.—Semidiagrammatic section through the right ear: *G*, External auditory meatus; *T*, membrana tympani; *P*, tympanic cavity; *o*, fenestra ovalis; *r*, fenestra rotunda; *B*, semicircular canal; *S*, cochlea; *Vt*, scala vestibuli; *Pt*, scala tympani. (Czermak.)

The inner ear is a very complex structure. The organ of hearing is the ending of the auditory nerve. This structure is arranged in a spiral that turns two and one-half times. It rests in a bony spiral and is exposed to a fluid that carries the vibrations received from the last bone of the middle ear. This vibration sets in motion the lymph of the internal ear and these waves of vibration stimulate the ends of the auditory nerve. Impulses pass over the nerve to the temporal lobes of the brain where hearing actually occurs.

Another portion of the internal ear is the receptor of a branch of the auditory nerve called the semicircular canals. These are tubes set at three dimensions in space. They convey impulses that inform regarding body position or equilibrium.

Septic Infections.—The word "sepsis" means a general disease produced by pus-forming bacteria. Specific disease such as typhoid and diphtheria are recognized as infections, but they are not classed as septic infections because the organisms are not pus producing. Typhoid bacilli select, as a rule, the small intestine for their development, and diphtheria bacilli choose usually the mucous membrane of the nose, pharynx, or larynx.

The organisms producing septic infections are of two types: streptococci and staphylococci. At times the pneumococcus is a factor and in certain tracts the colon bacillus is responsible for the trouble. These organisms may come from outside the body or they may come from the host where they have dwelled for some time without sign. The particular significance of this fact has only in recent years been fully appreciated.

It has been observed that foci of infection in the body may serve as sources from which organisms may be spread to distant parts of the body. There is usually a definite relation between the portal of entry and the lesion or diseased process that develops. This relationship is not established for all cases, but it is so definite in many instances that foci are always under suspicion when infection develops systemically in the body.

Portals of Entry.—The gates by which pus-producing organisms enter the body are several. The skin affords a large field. Boils and skin infections following cuts, abrasions, or other injuries may develop into general septic conditions. Certain disturbances in the gallbladder come from the extension of colon bacilli normally present in the intestinal canal, and these organisms may also invade the urinary tract, attacking the kidney, ureters, and bladder. While these forms exist and cause serious disturbance at times, the chief portal of entry is in the head and face. Teeth, tonsils,

nose, and sinuses are common pathways for organisms (Fig. 154). To understand the liability of these structures as foci of infection and the preventive measures to be applied is very important.[1] They will be discussed in the order given above.

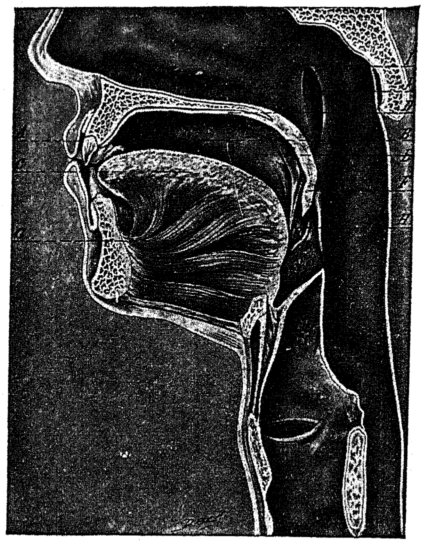


Fig. 154.—Vertical section of mouth, pharynx, and larynx: *A*, Vestibule; *B*, cavity of mouth proper; *C*, tongue; *D*, hard palate; *E*, soft palate; *F*, uvula; *G*, geniohyoglossus muscle; *H*, tonsil; *I*, nasopharynx; *J*, orifice of eustachian tube. (After Deaver.)

HYGIENE OF THE MOUTH, NOSE, AND SINUSES

Teeth.—The temporary teeth of the child are lost in the second dentition, and are replaced by a permanent set. Belief that the temporary teeth are unimportant is unfounded in fact.[2] Their care is significant for the following reasons: proper development and care of the temporary set determine the shape and size of the upper and lower jaw

[1] Langstroth, L.: *American Journal Medical Sciences*, February, 1918, p. 232.

[2] Snyder, J. R.: The Temporary Teeth, *Journal American Medical Association*, August 14, 1920, pp. 458–460.

bones; they condition the maturing of the permanent set, for if the temporary teeth are lost too early, the permanent teeth do not have the proper stimulus for growth; and finally, good oral hygiene is as important for the health of the child as it is for the health of the adult.

There are two schools of thought regarding the primary cause of dental decay. The older school is represented by those who believe that the exciting cause lies in local environmental factors, and the younger by those who believe that it lies in the field of nutrition.

The importance of oral hygiene for children, however, has been widely demonstrated. Fones in a five-year program of oral hygiene in the schools of Bridgeport reports a reduction in the educational budget spent on reeducation from 40 to 17 per cent.

The Cause of Dental Defects.—The weight of experimental evidence favors the view that caries is primarily a nutritional defect. The quality of tooth substance is determined in part before the child is born. The developing embryo must get the tooth-forming salts from the blood of the mother. Frequently the mother gives up needed and essential salts of her own body to the developing child because of insufficient content in her diet. It is extremely important, therefore, for the pregnant mother to select articles of diet from food with a high calcium content (see page 247).

After birth the importance of dietary factors is not to be forgotten. Too often oral hygiene is viewed too narrowly as a toothbrush affair merely. Dental deterioration is due to what is omitted from the diet rather than to what the diet contains. Attributing to candy or soft foods the cause of dental decay is not well supported. For example, the Rhodesian skull[1] shows "unmistakable evidence of dental caries, and even of abscesses at the roots of the teeth."[2]

Dental decay is not a modern disease apparently, but one experienced by our earliest ancestors.[3] While the evidence

[1] *Science*, p. 129, February 3, 1922.

[2] *Journal American Medical Association*, p. 586, February 25, 1922.

[3] Marshall, J. A.: The Etiology of Dental Caries, *Physiological Reviews*, October, 1924, p. 564.

is not complete, it would appear that the toothbrush, candy, and soft foods were unknown to primitive man, but that deficient dietary factors could play then the rôle that they are playing so surely today. For other good reasons the toothbrush should be used regularly and well, candy should not be eaten between meals, and coarse food requiring mastication should be selected. But reliance on such procedures for development of good teeth is precarious. Adequate diet is extremely important.[1]

Professor Edward Mellanby and his wife are well known in scientific circles for their work on rickets. Mrs. Mellanby has just published an experimental study on diet and teeth. She affirms that the character of the teeth and jaws, both in their general development and in their microscopical structure, can be greatly influenced by diet. The dietetic substances that tend to promote well developed and well calcified teeth are those which have a high content of vitamin A, but Mrs. Mellanby finds that there are certain differences in distribution between this vitamin and the factor favorable to calcification which indicate that they are not identical. The latter is now recognized as a separate entity and is generally known as vitamin D. Mrs. Mellanby produces evidence that the development of perfect teeth can be insured by an adequate supply of vitamin D, either as found in natural food, as egg yolk, milk, suet or cod liver oil, or as artificially produced by irradiation of the ergosterol content of foods or even by irradiation of the animal's skin. Proteins, carbohydrates and most vegetable fats and foods, such as cereals, oranges and egg white, have no calcifying power. Lard and bacon fat are usually deficient in vitamin D. Heating and simultaneous oxygenation gradually destroy vitamin D, and substances so treated lose their power to promote calcification of the teeth. An increase of cereal intake has a bad effect on calcification. Oatmeal has the most powerful decalcifying effect, white bread the least powerful. But a plentiful supply of vitamin D overcomes this tendency. Exercise plays little or no part in the de-

[1] McCollum, E. E.: The Effect of Diet on Health, *Journal of National Dental Association,* April, 1922.

velopment of the teeth. Mrs. Mellanby concludes that her experimental results "show that it is now possible to produce at will any degree of dental structure from the most perfect to the most imperfect, mainly by regulating diet. Although this problem is now under our control, it must be confessed that we know very little as to the intimate physiological processes whereby the specific substances which affect tooth calcification produce their effect, either individually or in relation to one another."

Recently also Boyd, Drain, and Nelson[1] report that they secured the arrest of dental caries in children by the comparatively simple formula of supplying diets rich in their mineral and vitamin content. Each child received cod liver oil, orange or tomato juice, milk, vegetables, and fruits daily in amounts to meet the requirements in vitamins and minerals. The protein allowance in every instance was at least a gram per pound of body weight.

An editorial in the Journal of the American Medical Association[2] presents a helpful point of view:

> It is generally accepted that age is a factor in the susceptibility to dental caries, the incidence being highest between the ages of seven and twenty. For this reason it would appear to be particularly important to secure data on the factors influencing the appearance of this disorder in the young, with a view to developing effective prophylactic measures. This is the thesis on which are based recent extensive studies of Bunting, Hadley, Jay, and Hard.[3] In a preliminary survey it had been observed that the prevalence of caries was much less among children given diets that would be generally regarded as adequate. In the main investigation and relative influence of antiseptic mouth washes, diet and a combination of these was studied. Five groups of children consisting of from 74 to 159 individuals were examined both before and after approximately a year had elapsed during which time the experimental measures were in effect. Four of the groups lived in state-supported institutions and so might be expected to have been under more or less satisfactory control.
>
> The first two groups were provided with a satisfactory diet from which sugar was eliminated, except as it was used to make the food palatable. In this diet milk, green vegetables and fruit were prominent.

[1] Boyd, J. D., Drain, C. L., and Nelson, Martha V.: Dietary Control of Dental Caries, *American Journal of Diseases of Children*, October, 1929.

[2] December 20, 1930, p. 1915.

[3] Bunting, R. W., Hadley, Faith P., Jay, Philip, and Hard, Dorothy G.: The Problem of Dental Caries, *American Journal of Diseases of Children*, September, 1930.

In addition to this favorable diet, an antiseptic mouth wash was used daily. At the end of the period of observation, caries was active in 5 and 6 per cent respectively of the children, while 80 and 79 per cent respectively were free from the disorder. In the third group, attending a public school, mouth antisepsis was practiced, but control of the diet was not attempted. After nine months, 50 per cent showed active caries and only 25 per cent were free: The fourth group consisted of children in a state public school and was provided with an "unusually good" though not ideal diet. Here the mouth wash was omitted, and after a year, 75 per cent were normal while only 6 per cent showed active caries. In the fifth group, in which the ration was not carefully balanced, neither dietary change nor preventive treatment was carried out. Eighteen per cent of these children were free from lesions, while 49 per cent showed active caries.

In spite of the fact that studies of large groups of human beings inevitably suffer the drawbacks of noncooperation and lack of suitable controls, the investigation of Bunting and his co-workers is impressive. In the three groups in which milk, fruits, and green vegetables were prominent in an otherwise well-balanced diet, the progress of caries was either greatly diminished or prevented entirely, and this result was obtained whether antiseptic mouth washes were used or not. It was also pointed out that these children were in excellent general health at the termination of the investigation. In those groups consuming diets not entirely satisfactory according to modern nutritional standards, the disorder was active and its rapid course was not arrested. Among these children, likewise, the use of oral antisepsis exerted little influence.

While the observations here discussed have demonstrated little that is new concerning the immediate cause of dental caries, they do emphasize again the importance of diet in the control or prevention of the disease. At first glance the beneficial effect of the better rations might be attributed to a metabolic change, in which case one is confronted with the difficulty of explaining a situation in which an apparently inert and inactive structure such as the enamel is so altered chemically that it is rendered in a comparatively short time either more resistant or more susceptible to the effects of substances in the mouth. The other point of view emphasizes the mechanical action of foods such as greens and raw fruits which have been demonstrated to be of value in the prophylaxis and prevention of caries. Regardless of the point of view from which the beneficial effect of adequate diet is considered, it is satisfactory to know that this prevalent disease of childhood and youth can be largely controlled by a procedure at once physiologic and highly beneficial for many other reasons.

Recent studies tend to eliminate the chemical condition of the saliva as a factor in caries. In their study of a group of 102 children, aged from seven to sixteen years, Hubbell and Bunting[1] observed no relation between the calcium and

[1] Hubbell, R. B., and Bunting, R. W.: Calcium and Phosphorus of Saliva in Relation to Dental Caries, *Journal of Nutrition,* November, 1932, p. 599.

phosphorus content of the saliva and the occurrence of dental caries. When the home diet was supplemented by the daily addition of 1 quart of milk and 2 ounces of tomato juice, with or without viosterol, there was a slight tendency toward a decrease in the incidence of dental caries. This improvement in tooth condition was not accompanied by any consistent change in the salivary calcium and phosphorus.

Teeth as Foci of Infections.—There is abundant evidence to show a causal relationship between infected teeth and many varied forms of general bodily disturbance. At times extreme claims are made and tooth extraction is expected to accomplish too much in health restoration. Reaction against overzealousness on the part of the inexperienced should not lose sight of the real facts. Evidence by both foreign and home clinicians is available. Antonius and Czepa,[1] following a systematic use of the *x*-ray in Falta's service, found that 66 per cent of 225 cases of various diseases had some infectious process at the root of one or more teeth. Their observations led them to affirm a causal relationship between focal infections in the teeth and nephritis, chronic septic endocarditis, joint and muscular rheumatism, neuralgia, and other disturbances.

The Life Extension Institute, Inc., reports that "in a recent series of 200 *x*-rays at the head office of the Institute, 67.5 per cent were found with infected roots or gums. Among 200 individuals there were 205 foci of infection found." Lambert[2] reports that in 1000 cases of rheumatism at Bellevue Hospital, 68 per cent showed bad teeth, and that since the establishment of the dental clinic in Bellevue "the number of rheumatics has decreased enormously."

In a recent study of dental infection and systemic disease Arnett and Eunis fail to establish a relationship after very thorough study of 883 college students. They report[3] as follows:

[1] Antonius, E., and Czepa, A.: *Wiener Archiv für innere Medizin*, Vienna, February 15, 1921, p. 293; (abstracted) *Journal American Medical Association.*

[2] Lambert, A.: *Journal American Medical Association*, October 16, 1920, p. 1041.

[3] Arnett, J. H., and Eunis, L. M.: Dental Infection and Systemic Disease, *American Journal Medical Sciences*, June, 1933, p. 777.

"Chronic rarefying osteitis with granulation tissue (the so-called "blind dental abscess") was revealed in 19.8 per cent of the group. It often occurred with underweight and albuminuria, but no statistically significant association could be demonstrated. It was not associated with rheumatism, chorea, and heart disease."

The story of dental infection is most interesting. At times the relationship seems clear enough because of alveolar abscess, marked inflammation, and frank evidence of decay. At other times the opposite is true. Quite often, however, the astounding *x*-ray shows the trouble to be in the root canal or at the tip of the tooth in the jaw, while quite disturbing to the layman is the fact that there may be no signs to the owner that anything is wrong with the teeth. Such cases are only revealed by the *x*-ray examination.

Because of experience, modern dentistry views with suspicion crowns and bridge work, and especially if these were mounted some years ago. It is not an extreme position that the dentist takes when he advises, after an *x*-ray diagnosis, that expensive crowns be removed or even that teeth be pulled for the purpose of eliminating sources of infection.

Pyorrhea Alveolaris.—"Pyorrhea" is a term to describe a variety of disturbances of the teeth and gums with characteristic changes in the bony alveolar process that holds the tooth. It begins at the gum margins and extends, causing marked inflammation. A common picture in well-developed pyorrhea shows the gums retracted so that the teeth appear abnormally long; the gums are red and bleed easily; and around their margin a yellowish pus exudes. A disagreeable taste in the mouth, foul breath, and disturbances of digestion are common results. More serious are general systemic infection of other parts due to invasion by pus organisms of the lymph and blood channels.

The cause is not clearly known, but in the majority of cases, "pyorrhea" is due to faulty care of the teeth. If the condition is well developed thorough dental prophylaxis is imperative.

How to Keep the Mouth and Teeth Clean.—There is considerable conflicting testimony regarding the efficacy of dif-

ferent methods of oral hygiene. Competent dentists are in essential agreement with the following procedures:

1. Brush the teeth daily, preferably after each meal. Use a rather stiff brush with uneven bristles and thoroughly cleanse all surfaces of the teeth. A rotary, across, and up-and-down motion are the proper movements to make. These are best made as vibration movements rather than movements of amplitude. Never neglect the night brushing. This is the most important single brushing.
2. One should have three toothbrushes, to be used alternately. This will give time for the bristles to thoroughly dry out.
3. Use a paste or powder that is not scratchy.
4. Food particles caught between teeth should be removed with dental floss. Care should be taken not to injure the gums.
5. An alkaline mouth wash is useful before retiring, although not essential if the mouth is in good condition. Lime water made from coarse unslaked lime may be used.
6. Cleansing of the tongue with a toothbrush used only for this purpose assists in the removal of decomposing material that at times causes foulness of breath.
7. Examination of the teeth by a good dentist every six months, preferably every three months, is strongly advised. Attention to this matter will prevent many defects from occurring. If evidence of dental defect develops, immediate attention should be given to it.

Tonsils as Foci of Infections.—The tonsils are lymphatic glands situated at the entrance to the throat, or pharynx. They lie in pockets or depressions between two bands of musculomembranous tissue called the pillars of the fauces. They serve, like all lymphatic tissue in the body, to protect against bacteria,[1] and because of their situation they are liable to become infected.

The evidence against the tonsils as foci of infection is very strong. Heart disease, rheumatic fever, and chorea have shown certain relationship. St. Lawrence[2] reports a study of 94 cases, and shows the effect of removal of the tonsils upon the recurrence of general disease (Fig. 155). After tonsillectomy the occurrence of rheumatic manifestations dropped from 85 per cent to slightly over 30 per cent.

[1] Davis, D. J.: The Tonsil in Relation to Infective Processes, *Journal American Medical Association*, January 31, 1920, pp. 317–320.

[2] St. Lawrence, W.: Effect of Tonsillectomy upon the Recurrence of Acute Rheumatic Fever and Chorea, *Journal American Medical Association*, October 19, 1920, pp. 1035–1041.

This work shows that the tonsils are the most important single portal of entry for rheumatic infections, and that their removal greatly decreases the liability of recurrences.

Less favorable results have been announced by Ingerman and Wilson[1] who used control groups in their studies. They report:

"A study of the relation between tonsillectomy and the occurrence of rheumatic manifestations showed that 76 per cent of 88 cases have been followed by recurrence of rheumatic manifestations in from one to eleven years after tonsillectomy. In a control group of 97 cases without tonsillectomy, studied over a similar period, 80 per cent

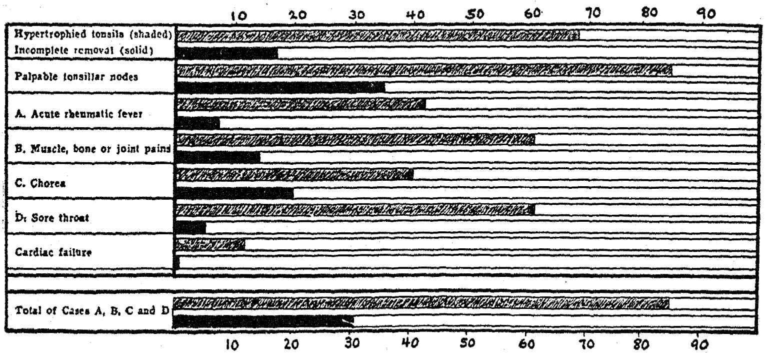


Fig. 155.—Effect of tonsillectomy on the recurrence of rheumatic manifestations: shaded area, number of cases before operation; solid area, number of cases after operation; figures above and below, number of cases. (By courtesy of Dr. William St. Lawrence.)

showed recurrence of rheumatic manifestations. Nonrecurrence of rheumatic manifestations has been observed in 24 per cent of 88 cases with tonsillectomy, and in 20 per cent of 97 cases without tonsillectomy. Of 18 cases with incomplete tonsillectomy, 78 per cent were followed by recurrence of rheumatic manifestations, and 22 per cent by nonrecurrence. All of these findings suggest a consideration of other less mentioned sources of infection. Any tissue, previously the seat of a rheumatic infection, would seem to be the most obvious source of focus or reinfection."

In a careful study of 1200 children, operated and compared with a control group of the same number not operated, Kaiser[2] offers the following conclusions:

[1] *Journal American Medical Association*, March 8, 1924, pp. 759–764.
[2] *Journal American Medical Association*, July 5, 1924, pp. 33–37.

1. Tonsillectomy offers a child considerable relief from such common complaints as sore throat, head colds, and mouth breathing.
2. It lessens the chances of having discharging ears and their complications.
3. It assures some protection against glandular infection, but is no guarantee against it, and it does not assure the immediate disappearance of large cervical glands.
4. It does not influence favorably or unfavorably infections of the larynx, bronchi and lungs, as they occur equally in the two groups.
5. It does not prevent scarlet fever or measles, but may influence the severity of the infections.
6. It seems to lessen the incidence of diphtheria by removing fertile soil for the diphtheria bacillus.
7. It has not influenced the incidence of chorea or rheumatism.
8. It has shown a lessened incidence of heart disease over a period of three years.
9. It has definitely reduced malnutrition in the group operated on as compared to the group that was not operated on.

Monroe and Volk[1] in a study of 736 tonsillectomies and of 741 controls conclude that tonsillectomy offers a child considerable relief from such common complaints as sore throat, head colds and mouth breathing, that complaints were relieved in 91 per cent of cases operated, that the controls do not show any improvement in the period of one year as compared with the 91 per cent having tonsillectomies.

Belief that removal of the tonsils causes injury to the voice, ears, or interference with the protective mechanism of the body is not well founded. The voice is usually improved after tonsillectomy, particularly if the tonsils are large. Only the amateur in surgery would damage the neighboring throat structures in the operation. In the second week after the operation pain in the ears may be quite marked, but this is temporary and of no vital significance. The protection to the body is unimpaired because the deeper lymphatic nodes take over the work formerly performed by the tonsils. Their protected position in the deeper tissues prevents exposure to the great number of bacteria constantly present in the mouth.

[1] Monroe, J. D., and Volk, V. K.: Studies of the Effects of 736 Tonsillectomies and of 741 Controls, *American Journal of Public Health*, May, 1930.

Finally, it should be remembered that removal of pathologic[1] tonsils, especially in children and young adults, results in most salutary effect upon the general health. In particular cases, colds, croup, and tonsillitis are greatly decreased both in severity and frequency. In children, an increase in weight is commonly noted, and favorable effects on the nervous system are most striking. In children the adenoids are usually removed at the time of the tonsillectomy (see page 310 for Adenoids).

For some adults and for those suffering from certain diseases, treatment with *x*-ray is preferable to operation.

The Nose and Sinuses as Foci of Infections.—Four bones of the skull contain distinct cavities which give rise, at times, to local or even general disturbance. These cavities are called sinuses, and all open into the nose or nasopharynx. The *frontal sinus* is located in the frontal bone immediately above the eyebrows; the *ethmoidal sinus* is a series of small cavities in the ethmoidal cells which open into the upper part of the nasal cavity; the *superior maxillary sinus* is a large cavity in the upper jaw bone on either side of the nose, and the *sphenoidal sinus* is a small cavity in the body of the sphenoid bone. This opens into the nasopharynx. These sinuses are lined with mucous membrane. During an acute cold, "influenza, pneumonia, scarlet fever, measles, diphtheria, typhoid fever, and other infective diseases"[2] infection and inflammation may develop in these cavities. Deformities in the nose which prevent free drainage of the sinuses or an infected tooth in the upper jaw opening into the sinus of the superior maxillary bone, are not uncommon ways in which trouble begins. Understanding of such processes should be helpful in seeing the futility of the punching or manipulating of the spine for "subluxations."

Acute inflammation in these centers may require, and often does demand, surgical attention. If not cared for

[1] Tonsils are considered to be pathologic (1) when they are hypertrophied (enlarged) and mechanically obstructive, or (2) when they are clearly infected. Recurring attacks of sore throat are suggestive of such infection.

[2] Coakley, C. G.: A Manual of Diseases of the Nose and Throat, Lea & Febiger, Philadelphia, 1914, p. 200.

properly, extension to the brain may occur, with fatal consequences. The sinuses do not play the same kind of a rôle as the teeth and tonsils apparently, and yet at times a chronic sinusitis is found to be the cause of general disturbance in health.

Mouth Washes, Sprays, and Gargles.—Liquids are used for cleansing the mouth cavity during an infection. During an attack of tonsillitis or pharyngitis local treatment is very helpful. The chief value lies in the mechanical washing of the inflamed part, and slight reliance should be placed upon drugs or chemicals unless prescribed by a physician.[1] The reason for insisting upon medical direction is the variable conditions that may be found. Shall an antiseptic only be used, an irritant, or an astringent? What preparation is selected depends upon the condition of the mucous membrane. A mouth wash of salt water, or bicarbonate of soda in water, is beneficial for removing mucus, but the claims of special curative values for advertised gargles and mouth washes are grossly exaggerated, to say the least.

Chronic conditions in the nose or throat may require sprays, gargles, or drops over a long period of time. The rational procedure is to secure from a specialist a prescription for the condition, and then follow his directions.

HYGIENE OF THE EYE

The Eyes Need Care.—The eyes of man developed to perform a function that has been greatly changed in modern civilization. The invention of Gutenberg has thrown enormous strain upon the eye by requiring it, in reading the printed page, to make many more movements than are ever called for in the environment of large objects. Many eyes are unable to make this adjustment. About 35 per cent of the school teachers in Germany wear glasses, though not more than 15 to 20 per cent in the United States. This difference Terman[2] suggests to be due to the "unwillingness

[1] The physician will wish to prescribe in accordance with the condition of the part to be treated.

[2] Terman, L. M.: The Teacher's Health, Houghton Mifflin Co., 1913, p. 66.

of our women teachers to risk the disfigurement of spectacles." There are many women who refuse to wear glasses because of pride, but this attitude is probably not the explanation for the condition found in this country. More people in all walks of life need and wear glasses in Germany

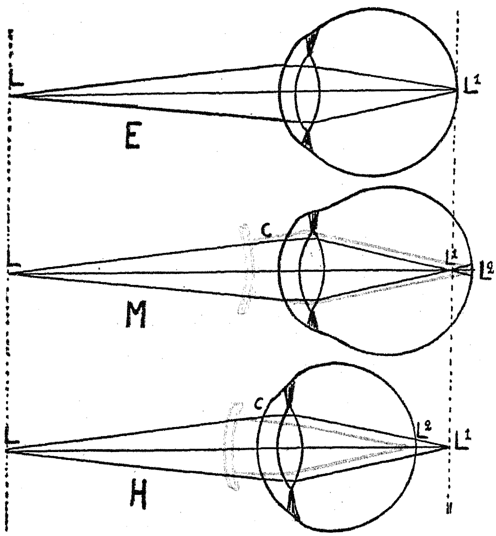


Fig. 156.—Diagram to illustrate the refraction in emmetropia and ametropia: *E*, Emmetropic eye in which luminous point *L* is brought to a precise focus upon the retina, L^1; *M*, myopic eye in which *L* is focalized in front of the retina, L^1; *H*, hypermetropic eye in which *L* is focalized in L^1 "behind" the retina. In *M* the use of a concave lens forces L^1 backward upon the retina, L^2, correcting the myopia, whereas in *H* the use of a convex lens forces L^1 forward upon the retina, L^2. (Burton-Opitz.)

than in America, because as a people the Germans are inclined to myopia and in America myopia is less frequent.

The use of eyeglasses and spectacles is recommended to correct abnormalities of eye structure or eye function (Fig. 156). Myopia (near sight), hyperopia (far sight), presby-

opia[1] (far-sight condition of advancing age), astigmatism (unequal curvature of the cornea—front part of the eye) are structural defects to be corrected by proper lenses placed in front of the eye. Weakness or insufficiency of the external muscles of the eyeball may be functional and disappear if strain is removed by proper lenses.

How to Care for the Eyes.—Intelligent care of the eyes will provide:

Early and Repeated Eye Examinations.—Such examinations should be made if the individual has headaches, or if, in reading, the book is held nearer than 12 inches. In children eye examinations are important whether or not a known disability exists. Headaches, holding a book or work nearer than 12 inches, or eye discomfort indicate an examination.

Examinations should be conducted by skilled operators. The oculist is a physician who examines the eye with reference to other conditions prevailing in the body. He does not merely refract the eye. The optometrist will determine the optical defect of the eye, but he is not in a position to interpret the eye condition in terms of general disease. If general disease is present the signs may be sufficient to lead the optometrist to refer the case. In kidney disease with its eye signs, arteriosclerosis, sarcoma of the eye, and similar conditions, the general disease may be more serious than the local eye disturbance.

Avoidance of fine work, especially by children. The effort to see small relationships, as in sewing, embroidery, drawing, painting, reading, and so forth, is a strain on the eye muscles. Such work should not be continuous for long periods. The preferred working position is with the object held 12 to 14 inches from the eyes. If vision is not clear the work should be moved up to the eye, not the eye down to the work.[2]

[1] Presbyopia is a very interesting condition. The near point of vision begins to recede at about the age of ten and continues throughout life. At about forty-five it has reached 12 inches, which is our distance for reading and many kinds of work, so that glasses are needed to bring back the near point to the working distance. Glasses for this purpose need to be changed every one to three years.

[2] Henderson, G. O., and Rowell, H. G.: Good Eyes for Life, D. Appleton-Century Co., New York, 1933.

Frequent rest for the eyes from study or close work. It will relieve the eyes to look up from close work and allow the eye to look into the distance. Objects 20 feet away are seen by the normal eye without any muscular effort. To look out of the window when doing close work indoors is a very desirable relief for the eye.

Good light. Good light for seeing purposes is light from a steady source, as near like the sun as possible, coming from above or from the side. Usually a 60-watt bulb in a reading or bridge lamp will provide adequate illumination for close work. In all writing it is important that the light come from the left for right-handed persons or from the right for left-handed persons.

Twilight is a poor light with which to do any fine work. For seeing purposes full sunlight may be undesirable because of too great intensity or glare.[1] Tinted glasses are desirable for some persons and for all in bright sunlight. Reading on a moving train or street car is hard on the eyes because of the wavering source of light, the shadows cast, and the constant change in the focus and adjustment of the external muscles of the eyes required by the vibrating book or paper.

Good light will have the following characters:

1. Steady source.
2. Sufficient intensity to illumine without glare.
3. No shadows produced on the reading or work surface.

Tinted glasses. In caring for the eyes it will be helpful to have tinted glasses for use in the bright sun, especially at the seashore, and during the winter while the snow is on the ground. They should also be used in strong winds, as in automobiling, unless one is obliged to wear glasses for other purposes.

Good general health. The eye responds quickly to lowered states of bodily efficiency. Good health means almost always right living, and the eyes will share in the general effects.

The Cause of Eye Defect or Disturbance.—The proper

[1] De Schweinitz, G. E.: Some of the Causes of Eye-strain and Their Prevention, *Hygeia*, April, 1923, p. 18.

care of the eyes results uniformly in good eyes. Lack of proper care causes a variety of eye defects or disturbances. Viewed from this angle, of course, we find the following:

1. General ill health, weakness or lowered vitality. The loss of tone in general is expressed in the eye in definite deterioration.
2. Excessive use of the eye. Students, teachers, laboratory workers, and all sedentary workers engaged in close eye work are liable to overuse the eye.
3. Poor light.
4. Irritating forces, such as chemicals, vapors, dust, wind, and excessive heat.
5. Disease of the eye, such as trachoma, pink eye, ulcer of the cornea, ophthalmia neonatorum, etc.
6. Hereditary factor may be a cause of certain abnormalities. The generally accepted opinion is that at birth all eyes are hyperopic, and that as development progresses the eyes in time become the proper size and shape with the refracting media acting symmetrically. If the cornea and lens do not refract rays to a common focus then there is astigmatism. If the eyeball does not enlarge to the proper size then there is hyperopia. If the eyeball tissues stretch or overdevelop then myopia is the result. Thus myopia is really acquired and hyperopia is congenital.
7. The stooping position in reading or at close work is considered to be a factor in myopia.

Uncorrected eye defects and abnormalities cause a variety of disturbing conditions that range all the way from headache to marked general ill health. Use of a defective eye demands extreme effort on the accommodation powers of the eye. It always strains the eye and wastes energy. All children should have the relief and help that scientific oculists can give; all adults owe it to themselves to secure optimum working conditions.

The Use of Drops and Other Treatments.—Drops are used in examination of the eye to paralyze the muscles of accommodation so that the actual defect in the eyeball may be determined. Atropine or homatropine is used for this

purpose. In the care of a skilled oculist there is no danger from the use of these drugs. Opticians, jewelers, nonmedical "refractionists," and peddlers are prohibited by law from using "drops." This is most fortunate, because their use in cases of glaucoma produces serious results. Persons with glaucoma (excessive pressure within the eyeball) suffer from failing vision, and are likely to be seeking for optical aid. The importance of this law is, therefore, very great.

Eye diseases and abnormalities offer a rich field for the charlatan and patent-medicine faker. Numerous *cures* or *remedies* are on the market claiming "to restore defective sight," "to make the eyes young again." As illustrative of this class of fraudulent preparations the following from Nostrums and Quackery[1] is given:

"The label on Eyelin contained the statements:

> *Repairs and Rejuvenates the Eye and Sight.*
> *Reshapes and Rejuvenates the Eye and Sight.*

Analysis of the stuff in the government laboratory disclosed the fact that it consisted essentially of vaselin, perfumed."

One dollar a box for vaselin, perfumed, to correct eye defects represents the honesty and integrity of the whole patent-medicine game. Exorbitant prices for simple preparations that are often worthless for the condition described.

Another preparation widely advertised is Murine. Before the advent of the Food and Drugs Act the carton in which this "eye water" was sold read as follows:

Murine A positive cure for Sore Eyes, Red, Inflamed, and Itching Lids.

After that law became operative, and a lying label was illegal instead of merely immoral, the legend of the carton was changed to read:

[1] Nostrums and Quackery, American Medical Association, Chicago, 1912, pp. 528, 605.

On analysis, Murine was found to be a water solution of borax (12 grains to the fluidounce). The price charged for Murine was $1 per ounce; the estimated cost of the preparation is 5 cents per gallon.

Common Disorders of the Eye.—Disorders of the eye are frequently of minor importance, but because of the delicate structure of the eye and the value of perfect vision, intelligent care should be given to all abnormalities, however trivial. The disorders commonly found may be grouped in three headings: injuries, infections, and systemic causes.

Injuries to the eye may result from a blow upon the face, resulting in the condition known as "black eye." The blackness is due to the breaking of blood vessels in the soft tissues around the eye with a flooding of blood into the tissues from the broken vessels. If care can be given immediately after the injury ice compresses will be most helpful. After discoloration has occurred hot compresses will be useful in promoting absorption of the extravasated exudate. Local medication is useless, and poultices, beefsteak, etc., are valuable only as they supply heat. A hot-water bag is more desirable from many standpoints than sirloin.

Injury from a foreign body in the eye is very common. The usual cinder, eyelash, or dust grain is not a serious disorder, but until removed it is extremely troublesome. To remove a foreign substance from the eye gently pull down on the lower lid and look in the lower sac for the irritation. If it is not seen, the upper lid must be everted for examination. To evert the upper lid grasp the edge of the lid with index finger and thumb of right hand, pulling forward and downward. Ask the patient to look downward, and at the same time turn the lid up over the thumb of left hand placed on the margin of the eye socket with nail side forward. Wipe off the particle with the corner of a *clean* handkerchief or

wisp of cotton. If the particle is embedded so that it is not easily removed, refer the case at once to a physician who can use sterile instruments.

Infections of the eye occur more frequently in childhood than in adult life. A common disorder is known as sty of the eye. A sty is an infection and inflammation of one of the glands along the margin of the eyelid. Its cause is not known. Some attribute eyestrain as a factor. Its prevalence in young children would suggest need for ocular examination. It may be caused by some other factor, such as infection due to rubbing the eye with dirty hands. Stys are not usually serious, but should be cared for carefully. When "ripe" they should be opened with a sterile needle, and the pus removed by gentle pressure with a bit of cotton on a toothpick. After expulsion the wound should be painted with 5 per cent argyrol and yellow oxide of mercury salve used in the eye.

"Pink eye" is an inflammation of the conjunctiva. There are two kinds: one seen in cases with cold in the head, influenza, eyestrain, or after exposure to wind or irritating smoke. This type is due to local causes. The other is an infectious inflammation of the conjunctiva, a conjunctivitis, that is very communicable. The pink eye from irritation should be treated by washing the eye with saturated solution of boric acid; the infectious conjunctivitis requires medical attention.

Purulent conjunctivitis of the newborn is commonly due to gonococcus infection. Before the law requiring obstetricians and midwives to use silver nitrate in the eyes of all infants at birth, this condition was a common cause of blindness.

Trachoma is an exceedingly communicable disease of the eye characterized by granules in the conjunctiva of the lids. It is largely seen among children (especially those of foreign birth) of crowded section in city schools. It may result in impairment or even total loss of vision. Granular conditions of the lids of a simple type are not to be confused with trachoma. All granular conditions of the eye should be examined by a physician.

Systemic causes of eye disorders are the diseases that

show certain eye changes. Thus, kidney and heart disease may be indicated by swelling and baggy formations under the eye; locomotor ataxia shows characteristic pupillary changes, and various poisons indicate their effects in retinal changes.

Blepharitis is an inflammation of the margins of the eyelids. If neglected the eyelashes fall out, not to be replaced. This makes an unsightly deformity.

Chalazions are caused by infections of the ducts and glands along the inner side of the lids. They occur quite commonly. They may appear very much like a sty, and at first it is difficult to decide whether there is a sty or chalazion forming. The latter is sometimes spoken of as a blind sty.

HYGIENE OF THE EAR

The Ear Needs Care.—The ear is subjected in the modern world to a variety and intensity of sound waves out of all proportion to the forces acting when the hearing apparatus was evolved, but the adjustment necessary in modern life affects not so much the organ of hearing as it does the nervous system in general. Noise wastes human energy. Quiet and harmonious sounds are very beneficial. The ear carries to the nervous system all sounds; unfortunately for modern man it is not more selective.

The ear itself is important, however, because it is frequently infected and because it offers a pathway for infection to the mastoid cavities, and even to the brain itself. In the upper part of the throat there opens the eustachian tube that leads from the middle part of the ear structure (Fig. 153). Normally the tube serves to permit an equalization of air pressure in the middle ear with that existing outside the body. Any good book on physiology will explain this structure and function. This middle part of the ear from which the eustachian tube leads has another passageway that connects with the cavities of the bony prominence felt behind the ear, *i. e.*, the mastoid. Infection carried into the middle ear by means of the eustachian tube may extend to the mastoid and thence to the brain, requiring surgical operation or resulting in death.

How to Care for the Ear.—*Prevent so far as possible all*

infections of the nose and throat. In children especially this is to be interpreted to mean also prevention of the communicable diseases of childhood, namely, measles, whooping cough, scarlet fever, and diphtheria. Measles, whooping cough, and scarlet fever are not infrequently complicated by middle-ear disease which may result in deafness or even in death.

Remove adenoids in children if symptoms are present but not as a routine procedure. The adenoid tissue growing near the opening of the eustachian tube causes deafness of varying degrees by shutting off partially or completely this opening.

Avoid diving in cold salt water. In all diving the pressure of the water may force infectious material up the eustachian tube. This has been noted to occur more frequently in salt-water diving. Apparently this is due to the action of salt water in clearing the mucus from the nose and throat and especially from the opening of the tube. Exposure to cold causes ear disturbance at times.

Carefully remove excess wax in the ear canal. The wax that is secreted in the ear canal is a normal and useful product. At times it increases to excess and needs removal to restore hearing. One should never attempt to clean the wax out oneself. The use of hairpins and other hard objects should be avoided. Probably less damage results from wax in the canal than from amateur instrumentation.[1]

Refer to a physician all disturbances of the ear. At times foreign substances get into the ear canal. Insects may fly in or children may put into the ear objects, such as a pea, grain of corn, small toys, beads, etc. They need careful removal.

Careful watch of the ear must be kept throughout a cold, an attack of croup, measles, whooping cough, or scarlet fever in babies and children. Since they are usually unable to tell what hurts them, it is necessary to rely upon daily examination by the physician to avoid serious complications.

[1] Phillips, W. C., and Rowell, H. G.: Your Hearing, D. Appleton-Century Co., New York, 1932.

Earache accompanying a cold, croup, sore throat, or communicable diseases is caused by infection carried into the middle ear. The practice of putting oil into the ear is traditional and unscientific. Heat in the form of a hot-water bag to the ear or gently syringing the ear with warm water will give relief.

The Mastoid.—Prevention of middle-ear disturbance by avoidance of the communicable diseases is important not only for the ears, but also for the mastoid. Disease of the middle ear may extend to the mastoid, which communicates with the ear. If not cared for properly and promptly the infection, spreading to the brain, may result fatally.

QUESTIONS AND EXERCISES

1. State the characteristics of infectious diseases.
2. What organisms produce septic infections?
3. Enumerate the various foci of infection.
4. State reasons for caring for temporary teeth.
5. Discuss the various views regarding the cause of dental caries.
6. State evidence showing the relationship between infected teeth and general health of the body.
7. List essential procedures in oral hygiene.
8. Locate and describe the tonsils. State their function.
9. State the relation of diseased tonsils to general health.
10. State advantages of tonsillectomy for children with infected tonsils.
11. How may the nose and sinuses serve as foci of infection?
12. State your conclusions regarding the use of mouth washes, sprays, and gargles.
13. List rules for the care of the eyes.
14. State causes of eye defects.
15. Discuss common disorders of the eye.
16. List rules for the care of the ear.
17. What is the relationship of infections in the nose or throat to the mastoid?

APPENDIX A

SELECTED DATA OF COMMUNICABLE DISEASE[1]

ANKYLOSTOMIASIS (HOOKWORM DISEASE):

1. *Recognition of the disease:* Light degrees of infestation may produce no striking clinical symptoms, although some degree of secondary anemia and slight interference with bodily and mental development may be noted. A medium degree of infestation shows marked anemia and, if before puberty, definite physical and mental retardation, and a dry dirty-yellow skin. Severe

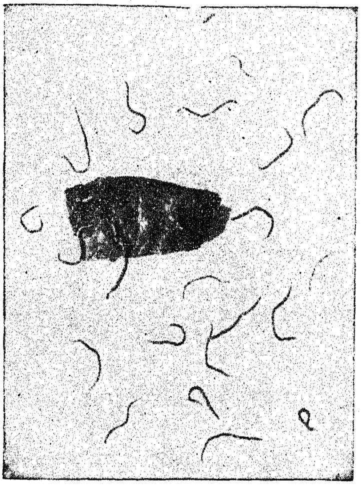


Fig. 157.—Hookworm (*Ankylostoma duodenale*), life size. Shows some worms adherent to a bit of intestinal mucosa and some free. (From Jefferys and Maxwell.)

infestations may show petechiae and atrophy of the skin, edema, general or of dependent parts, extreme anemia, anxious, stupid expression, prominent abdomen. The diagnosis is definitely established by finding ankylostoma ova in the stools, by smear or flotation methods.

2. *Etiological agent:* In the United States, *Necator americanus*, rarely *Ankylostoma duodenale* (Fig. 157).

[1] By permission of the Subcommittee on Communicable Disease Control, American Public Health Association, 1935.

3. *Source of infestation:* Feces of infected persons. Infestation generally takes place through the skin, occasionally by the mouth.
4. *Mode of transmission:* The larval forms pierce the skin, usually of the foot, and, passing through the lymphatics to the vena cava and the right heart, thence in the blood stream to the lungs, they pierce the capillary walls and pass into the alveoli. They then pass up the bronchi and trachea to the throat, whence they are swallowed and finally lodge in the small intestine. Also by drinking water containing larvae, by eating soiled food, by hand to mouth transmission of the eggs or larvae from objects soiled with infested discharges. The chief reservoir of infectious material is *contaminated soil.*
5. *Incubation period:* No incubation period occurs comparable to that observed in bacterial and virus infections. Onset of symptoms varies widely in time, according to the intensity of the infestation, from two to three weeks in massive infestations (commonly seven to ten weeks), to many months or even years where infestation or reinfestation is by small numbers of worms. The free living form may exist in the soil under favorable conditions for several weeks. Eggs are found in the stools in about four to six weeks after the larvae penetrate the skin, and develop the next generation of larvae five to eight days after being deposited on soil under favorable conditions.
6. *Period of communicability:* As long as the parasite or its ova are found in the bowel discharges of an infested individual. Contaminated soil may remain infective for five months in the absence of freezing. An individual can communicate the disease to others only by the indirect method of pollution of the soil with his feces. As long as mature female worms are in the intestine, eggs, if deposited in the feces in warm moist soil, become sources of infestation, especially where the soil is sandy.
7. *Susceptibility and immunity:* Susceptibility to infestation is universal, although among adults, especially Negroes, infestations are likely to be less heavy than among children and in the white races. Immunity does not develop after infestation.
8. *Prevalence:* Endemic widely throughout those climatic belts where frost does not last more than six weeks in the year, and particularly where the soil is sandy. In rural areas of the southern states of the United States, particularly among white children of school age; less commonly and less severely among Negro children. Damp summer weather increases the prevalence of infestation. During the past two decades there has been a decrease in prevalence and severity of the disease in continental United States. Prevalence high in Puerto Rico.
9. *Methods of control:*
   (*A*) The infested individual, contacts, and environment:
   1. Recognition of the disease and reporting: Microscopic examination of bowel discharges.
   2. Isolation: None.
   3. Concurrent disinfestation: Sanitary disposal of bowel discharges to prevent contamination of soil and water.

4. Terminal disinfestation: None.
5. Quarantine: None.
6. Immunization: None.
7. Investigation of source of infestation: Each case and carrier is a potential or actual spreader of the disease and should be brought under treatment and his family contacts examined.
8. Treatment: Appropriate treatment of infested persons with carbon tetrachloride, oil of chenopodium, or tetrachlorethylene, to rid intestinal canal of parasite and its ova.

(*B*) General measures:

1. Education as to dangers of soil pollution and methods of prevention.

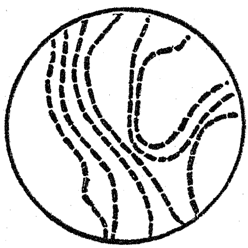


Fig. 158.—Drawing of anthrax bacilli. Note how they form long chains. (Lehmann and Neumann.)

2. Prevention of soil pollution by installation of sanitary disposal system for human discharges, especially sanitary privies in rural areas.
3. Personal prophylaxis by cleanliness and wearing of shoes.

ANTHRAX:

1. *Recognition of the disease:* Two forms occur—external due to direct inoculation through a cut or abrasion, and internal caused by ingestion or inhalation of the bacilli or their spores. Following the initial papule and vesicle at the external site of inoculation, an eschar develops and then hard edematous swelling of deeper and adjacent tissues. Freedom from pain is usual. Constitutional symptoms do not parallel the gravity of the lesions. Confirmation by microscopic examination of the lesions and discharges for *Bacillus anthracis.*

   Internal anthrax resembles intestinal poisoning, toxic pneumonia, or meningitis; the recovery of the bacilli from the blood or spinal fluid confirms the diagnosis.
2. *Etiological agent:* Anthrax bacillus, *B. anthracis* (Fig. 158).
3. *Source of infection:* Hair, hides, flesh, and feces of infected animals.
4. *Mode of transmission:* Inoculation as by accidental wound or scratch, inhalation of spores of the infectious agent, ingestion of

insufficiently cooked meat, and mechanically by flies and mosquitoes.

5. *Incubation period:* Within seven days, usually less than four.
6. *Period of communicability:* During the febrile stage of the disease and until lesions have ceased discharging. Infected hair and hides of infected animals may communicate the disease many months after slaughter of the animal and after drying of hide, fur, or hair, unless disinfected.
7. *Susceptibility and immunity:* Man is not as susceptible as the domestic animals, especially the herbivora, but more so than the carnivora. Immunity may develop following an attack of the disease. Artificial active immunity, widely used for domestic animals, is not appropriate for humans.
8. *Prevalence:* Rare and sporadic in humans and associated only with the occurrence of the disease in cattle, or with handling hide and hair products from infected cattle. In epidemic form in cattle in various foreign countries from time to time.
9. *Methods of control:*
   (*A*) The infected individual, contacts, and environment:
   1. Recognition of the disease and reporting: Clinical and bacteriological.
   2. Isolation of the infected individual until the lesions have healed.
   3. Concurrent disinfection of the discharges from lesions and articles soiled therewith: Spores can be killed only by special measures such as steam under pressure or burning.
   4. Terminal disinfection: Thorough cleaning.
   5. Quarantine: None.
   6. Immunization: None.
   7. Investigation of source of infection: Search for the product of the infected animal, and trace to origin for discovery of disease in sporadic or epidemic form in domestic animals, where it will be found in all but rare instances.

   (*B*) General measures:
   1. **Animals ill with disease presumably anthrax should be isolated immediately in the care of a veterinary surgeon. Animals proved to have the disease should be killed and promptly destroyed, preferably by incineration.**
   2. Immunization of exposed animals under direction of federal or state department of agriculture.
   3. Postmortem examination should be made only by a veterinary surgeon or in the presence of one.
   4. Milk from an infected animal should not be used during the febrile period.
   5. Control and disinfection of effluents and trade wastes and of areas of land polluted by such effluents and wastes from factories or premises, where spore-infected hides or other infected hide and hair products are known to have been worked up into manufactured articles.

6. Every shipment of raw hides, hair or bristles from sources which are not known to be free from anthrax infection should be examined by an expert bacteriologist.
7. A physician should be constantly employed by every company handling raw hides, or such companies should operate under the direct supervision of a medical representative of the health department.
8. Every employee handling raw hides, hair, or bristles who has an abrasion of the skin should immediately report to a physician.
9. Special instruction should be given to all employees handling raw hides in regard to the necessity of personal cleanliness.
10. Tanneries and woolen mills should be provided with proper ventilating apparatus so that dust is promptly removed before reaching the respiratory tract of human beings.
11. Disinfection of hair, wool, and bristles of animals originating in known infected centers before they are used or assorted.
12. The sale of hides from an animal infected with anthrax should be prohibited. A violation of this regulation should be immediately reported to the appropriate state commissioner of agriculture by telegram, stating the time, place, and purchaser to whom the hide was sold. The report should also be sent to the person purchasing the hide. Carcasses should be disposed of under the supervision of the appropriate department of agriculture. The inspection and disinfection of imported hides are under the supervision of the United States Bureau of Animal Industry. In the event that infection is introduced, the state agriculture authorities have jurisdiction over infected animals and the local or state health authorities have jurisdiction over infected persons.

CHICKENPOX:

1. *Recognition of the disease:* Clinical picture is of an acute disease with a slight fever, mild constitutional symptoms, and an eruption, maculopapular for a few hours, often not observed, vesicular lasting three to four days leaving a granular scab. Vesicles tend to be as abundant on the covered as on the exposed parts of the body, and frequently appear in different stages on the same region of the body.
2. *Etiological agent:* A specific filtrable virus.
3. *Source of infection:* The infectious agent is presumably present in the lesions of the skin and of the mucous membranes; the latter, appearing early and rupturing as soon as they appear, render the disease communicable early, that is, before the exanthem is in evidence.
4. *Mode of transmission:* Directly from person to person; indirectly

through articles freshly soiled by discharges from an infected person.

5. *Incubation period:* Two to three weeks.
6. *Period of communicability:* Probably not more than six days after the appearance of the first crop of vesicles, and certainly not more than ten days. Especially communicable in the early stages of the eruption. One of the most readily communicable of diseases.
7. *Susceptibility and immunity:* Susceptibility is practically universal among those who have not previously had the disease. An attack confers permanent immunity, with rare exceptions. Passive temporary immunity may be conferred by the use of convalescent serum from those recently recovered.
8. *Prevalence:* Universal. Probably 90 per cent of persons have had the disease before the age of fifteen. Not uncommon in early infancy. Winter and spring are seasons of greatest prevalence in North America.
9. *Methods of control:*
   (*A*) The infected individual, contacts, and environment:
      1. Recognition of the disease and reporting: The chief public health importance of this disease is that cases thought to be chickenpox in persons over fifteen years of age, or at any age during an epidemic of smallpox, are to be investigated to eliminate the possibility of their being smallpox.
      2. Isolation: Exclusion from school, and avoidance of contact with nonimmune persons should be made effective.
      3. Concurrent disinfection: Articles soiled by discharges from lesions.
      4. Terminal disinfection: Thorough cleaning.
      5. Quarantine: None.
      6. Immunization: Passive immunization of susceptible children may be of value in institutions when exposure is feared, or under exceptional conditions in individual cases.
      7. Investigation of source of infection: Of no importance unless in persons over fifteen years of age or when smallpox is suspected or is locally prevalent.

   (*B*) General measures: None.

CHOLERA:

1. *Recognition of the disease:* In a few mild cases, diarrhea may be the chief or only symptom. In the typical case, rice-water stools, vomiting, and general symptoms of dehydration occur with thirst, pain, and coma. The cholera vibrios are found in the stools.
2. *Etiological agent:* Cholera vibrio, *Vibrio comma.*
3. *Source of infection:* Bowel discharges and vomitus of infected persons, and feces of convalescent or healthy carriers. Ten per cent of contacts may be found to be carriers.
4. *Mode of transmission:* By food and water polluted by infectious agent; by contact with infected persons, carriers, or articles freshly soiled by their discharges; by flies.

5. *Incubation period:* One to five, usually three, days, occasionally longer if healthy carrier stage before development of symptoms is included.
6. *Period of communicability:* Usually seven to fourteen days or longer and until the infectious organism is absent from the bowel discharges. A high degree of communicability is usual.
7. *Susceptibility and immunity:* Susceptibility is general, although natural immunity appears to exist to a limited degree. Acquired immunity is uncertain. Active artificial immunity for about one year may be obtained by vaccines.
8. *Prevalence:* Rare in North America. Appears in epidemic form frequently in the Philippines. Does not occur sporadically, except as an isolated case is discovered in the course of maritime quarantine enforcement.
9. *Methods of control:*
   (*A*) The infected individual, contacts, and environment:
      1. Recognition of the disease and reporting: Clinical symptoms confirmed by bacteriological examination of stools.
      2. Isolation of patient in hospital or screened room during communicable period.
      3. Concurrent disinfection: Prompt and thorough disinfection of the stools and vomited matter. Articles used by and in connection with the patient must be disinfected. Food left by the patient should be burned.
      4. Terminal disinfection: The room in which a sick patient was isolated should be thoroughly cleaned.
      5. Quarantine: Contacts for five days from last exposure, or longer if stools are found to contain the cholera vibrio.
      6. Immunization: Prophylactic immunization of contacts is useful and advisable.
      7. Investigation of source of infection: Search for contaminated food and water as common origin of groups of cases, and for unreported cases and for carriers.

   (*B*) General measures:
      1. Rigid personal prophylaxis of attendants by scrupulous cleanliness, disinfection of hands each time after handling patient or touching articles contaminated by dejecta, the avoidance of eating or drinking anything in the room of the patient, and the prohibition of those attendant on the sick from entering the kitchen.
      2. The bacteriological examination of the stools of all contacts to determine carriers. Isolation of carriers.
      3. Water should be boiled, if used for drinking or toilet purposes, or if used in washing dishes or food containers, unless the water supply is adequately protected against contamination or is so treated, as by chlorination, that the cholera vibrio cannot survive in it.

4. **Careful supervision of food and drink: Where cholera is prevalent, only cooked foods should be used. Food and drink after cooking or boiling should be protected against contamination, as by flies and human handling.**

(*C*) Epidemic measures: Inspection service for early detection and isolation of cases; examination of persons exposed in infected centers for detection of carriers, with isolation or control of carriers; cleaning of rooms occupied by the sick, and the detention, in suitable camps for five days, of those desirous of leaving for another locality. Those so detained should be examined for detection of carriers.

Conjunctivitis (of the Newborn), Acute Infectious (Not Including Trachoma):

(This title to replace the terms "gonorrheal ophthalmia," "ophthalmia neonatorum," and "babies' sore eyes.")

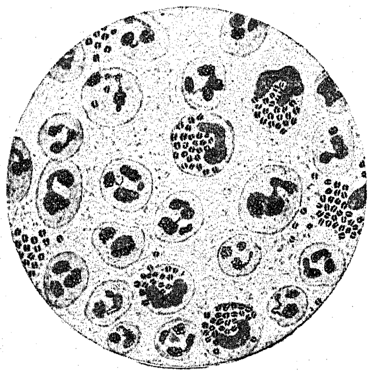


Fig. 159.—Pus from gonorrhea, showing gonococci. See also Fig. 142. (Jakob.)

1. *Recognition of the disease:* Acute redness and swelling of the conjunctiva of one eye or of both eyes, with mucopurulent and purulent discharge in which the infecting micro-organism is identifiable by microscopic and cultural methods.
2. *Etiological agent:* The gonococcus (Fig. 159) or some member of a group of pyogenic organisms, including the hemoglobinophilic bacilli.
3. *Source of infection:* Discharges from conjunctivae, or adnexa, or genital mucous membranes of infected persons.
4. *Mode of transmission:* Contact with an infected person or with articles freshly soiled with discharges of such person.
5. *Incubation period:* Irregular, but usually thirty-six to forty-eight hours.
6. *Period of communicability:* During the course of the disease and

until the discharges from the infected mucous membranes have ceased. Readily communicable.

7. *Susceptibility and immunity:* Susceptibility is general, particularly in the newborn. Acquired immunity does not follow an attack of the disease, and artificial immunity is not practicable.
8. *Prevalence.*—Occurrence varies widely according to the observance or neglect of prophylactic use of a solution of silver nitrate or equivalent preparation in the eyes of the newborn by the attendant at the delivery. An infrequent complication in the present-day care of the newborn.
9. *Methods of control:*
   (*A*) The infected individual, contacts, and environment:
      1. Recognition of the disease: Clinical symptoms, confirmed where possible by bacteriological examination.
      2. Isolation: None, provided the patient is under adequate medical supervision.
      3. Concurrent disinfection: Disinfection of conjunctival discharges and articles soiled therewith.
      4. Terminal disinfection: Thorough cleaning.
      5. Quarantine: None.
      6. Immunization: None.
      7. Investigation of source of infection—among persons recently in contact with the patient: The disease in the newborn is almost always due to infection from the genital tract of the mother.

   (*B*) General measures:
      1. **Use of silver nitrate or some similar solution in the eyes of the newborn: antepartum treatment of mother if gonorrhea is suspected.**
      2. Enforcement of regulations forbidding the use of common towels and toilet articles. Education as to personal cleanliness.
      3. Carrying out the measures indicated in methods of control for gonorrhea.

DIPHTHERIA:

1. *Recognition of the disease:* An acute febrile infection, generally of air passages, especially of tonsils, throat, and nose, marked by patch or patches of dirty white and grayish membrane from which cultures of the diphtheria bacillus may be obtained. Cases of diphtheritic infection in infants are often missed due to lack of definite local symptoms.
2. *Etiological Agent:* Diphtheria bacillus, *Corynebacterium diphtheriae*, the Klebs-Loeffler bacillus (Fig. 160).
3. *Source of infection:* Discharges from diphtheritic lesions of nose, throat, conjunctiva, vagina, and wound surfaces. Secretions from the nose and throat of carriers of the bacillus.
4. *Mode of transmission:* Directly by personal contact, indirectly by articles freshly soiled with discharges, or through infected milk or milk products.
5. *Incubation period:* Usually two to five days, occasionally longer if the carrier state precedes the development of clinical symptoms.
6. *Period of communicability:* Variable, until virulent bacilli have

disappeared from the secretions and the lesions. Usually two weeks or less, seldom over four weeks. In exceptional cases virulent bacilli remain in the throat and discharges from two to six months.

7. *Susceptibility and immunity:* Infants born of mothers with an established immunity are relatively immune for the first six months of life. By the ninth month of life this passive congenital immunity has been lost in a high percentage of infants. Subsequently children and adults develop immunity apparently in approximate proportion to their contact with associates who carry the diphtheria bacillus with or without exposure to persons with recognized attacks of the disease. It is usual to find about half of the children of school age and three quarters of adults in large cities immune. Such accidental immunity is less frequent among rural and small-town populations. Passive

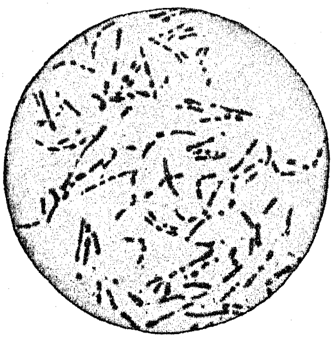


Fig. 160.—Bacillus diphtheriae, fifteen-hour serum culture. Loeffler's methylene blue; × 2000. (Denny, in Journal of Medical Research.)

temporary immunity (ten days to three weeks) and active immunity of commonly permanent duration can be developed artificially. Recovery from attack of the disease, especially if with the aid of therapeutic diphtheria antitoxin, is not necessarily followed by active immunity.

8. *Prevalence:* Endemic and epidemic. Two thirds or more of the urban cases are in children under ten years of age and two thirds or more of the urban deaths occur in children under five years of age. More common in temperate zone than elsewhere, and in fall and winter months. Local increased prevalence may occur in irregular cycles of four- to eight-year intervals. Reduction in incidence, death rate, and case fatality rate has been progressive and marked in the past thirty years.[1]

[1] The falling birth rate and widespread immunization of young children in the past decade have in some cities and rural areas altered the age distribution of cases of diphtheria to a marked degree.

9. *Methods of control:*
   (*A*) The infected individual, contacts, and environment:
      1. Recognition of the disease and reporting. By clinical symptoms with confirmation by bacteriological examination of discharges.
      2. Isolation: Until 2 cultures from the throat and 2 from the nose, taken not less than twenty-four hours apart, fail to show the presence of diphtheria bacilli. Isolation may be terminated if the microorganism reported as morphologically "positive," although persistently present, proves to be an avirulent form. Where termination by culture is impracticable, cases may be terminated with fair safety as a rule sixteen days after onset of the disease. A virulence test should be made, if practicable, where positive throat cultures are reported three weeks or longer after onset of the disease.
      3. **Concurrent disinfection of all articles which have been in contact with the patient, and all articles soiled by discharges of the patient.**
      4. Terminal disinfection: At end of illness, thorough airing and sunning of sick room, with cleaning or renovation.
      5. Quarantine: All intimate contacts until shown by bacteriological examination not to be carriers.
      6. Immunization: Passive immunization with antitoxin is rarely necessary for exposed persons over five years of age, for whose protection daily examination by a physician or nurse suffices. Infants and young children exposed to diphtheria in the family should receive a prophylactic dose of antitoxin without prior Schick testing, unless they are already known to the physician to be immune.
      7. Investigation of source of infection: In unreported cases, in carriers, and milk.
   (*B*) General measures:
      1. **Active immunization of all children, without prior Schick testing, at the age of six months, with a diphtheria toxoid. This same procedure should be applied to all children at or below six years of age if immunization has been neglected in infancy.**[1]
      2. Older children, and adults especially exposed, including teachers, nurses, and physicians found to be Schick-positive, should be actively immunized. In order to minimize local and constitutional reactions in members of these groups, it is desirable to carry out a preliminary "toxoid reaction test," nonreactors to receive toxoid, and reactors toxin-antitoxin in two or three inoculations or suitably diluted toxoid.

[1] Active immunization by any method should not be presumed to be successful without routine Schick testing or testing a representative sample of those inoculated three months after such procedure.

3. Pasteurization of milk supply.
4. Educational measures to inform the public, and particularly the parents of little children, of the advantages of toxoid immunization in infancy.

DYSENTERY, AMEBIC (AMEBIASIS):

1. *Recognition of the disease:* Insidious and undetermined onset characterizes mild acute cases, with digestive disturbance, anorexia, diarrhea or constipation, and usually little abdominal discomfort. Severe acute cases following massive infection may simulate acute appendicitis or other acute surgical abdominal condition with high temperature and severe prostration. The subacute and chronic forms of the disease vary widely in the extent of local and constitutional symptoms. There may or may not be diarrhea or constipation; or these may alternate in the same patient.
2. *Etiological agent: Endamoeba histolytica* (Fig. 161).

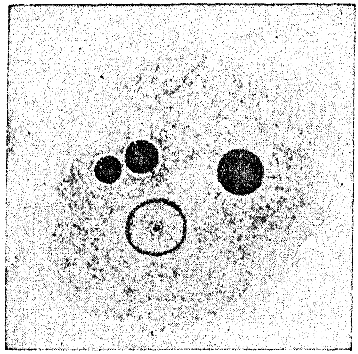


Fig. 161.—*Endamoeba histolytica* with three red blood cells within the ameba (× 2000). (After Dobell and O'Connor.)

3. *Source of infection:* The bowel discharges of infected persons and of carriers.
4. *Mode of transmission:* By drinking contaminated water and by eating infected foods, especially those that are commonly served cold and moist, and hand-to-mouth transfer of infected material; from moist objects soiled with discharges of an infected individual; by flies.
5. *Incubation period:* From two days in severe infections to several months in subacute and chronic cases; commonly three to four weeks.
6. *Period of communicability:* During course of infection and until repeated microscopic examination of stools shows absence of the *Endamoeba histolytica* (either trophozoites or cysts). Direct transmission unusual.

7. *Susceptibility and immunity:* Susceptibility to infestation is general; immunity uncertain; no artificial immunity.
8. *Prevalence:* Not a common disease clinically in continental North America. Epidemic outbreaks are rare. It is estimated that almost 5 per cent of the population are carriers of cysts.
9. *Methods of control:*
   (*A*) The infected individual, contacts, and environment:
   1. Recognition of the disease and reporting: Clinical symptoms confirmed by microscopic examination of stools.
   2. Isolation: None.
   3. Concurrent disinfection: Sanitary disposal of the bowel discharges. Hand washing after use of toilet.
   4. Terminal disinfection: Cleaning.
   5. Quarantine: None.
   6. Immunization: None.
   7. Investigation of source of infection: Microscopic examination of stools of inmates of the household, or of work associates of the infected person, and of other suspected contacts, should be supplemented by search for direct contamination of water and foods by human feces.

   (*B*) General measures:
   1. Sanitary disposal of human feces.
   2. Protection of potable water supplies against fecal contamination, and boiling drinking water where necessary. Chlorination of water supplies as generally used has been found inadequate for the destruction of cysts.
   3. Supervision of the general cleanliness, of the personal health and sanitary practices of persons preparing and serving food in public eating places, especially moist foods eaten raw.
   4. Education in personal cleanliness, particularly washing hands with soap and water after evacuation of the bowels.
   5. Control of fly breeding and protection of foods against fly contamination by screening.
   6. It is of importance that all cross connections between portable and polluted water supplies be forbidden. Systematic inspection should be made to discover them, and the supply should be disconnected until such cross connections have been eliminated.
   7. Instruction of convalescent and chronic carriers in personal hygiene, particularly as to sanitary disposal of fecal waste, and hand washing after use of toilet.

   (*C*) Epidemic measures: In case of epidemics due to relatively massive doses of infectious material, active measures should be employed to discover the source of infection, and to warn the public and the medical profession of the early and characteristic symptoms, and of the serious immediate and remote results of such infection.

DYSENTERY, BACILLARY:

1. *Recognition of the disease:* The typical case exhibits an acute onset, fever, tenesmus, with frequent stools containing blood and mucus. One or more of a large number of possible types of the dysentery bacillus can usually be found in the stools in the first two days of the disease.
2. *Etiological agent:* Dysentery bacillus, *Shigella dysenteriae* (Fig. 162), *Shigella paradysenteriae.*
3. *Source of infection:* The bowel discharges of infected persons.
4. *Mode of transmission:* By eating infected foods, and by hand-to-mouth transfer of infected material; by flies; from objects soiled with discharges of an infected individual or of a carrier; by drinking contaminated water. Polluted milk and water are less common vehicles of this disease than is the case with typhoid fever.
5. *Incubation period:* Two to seven days.

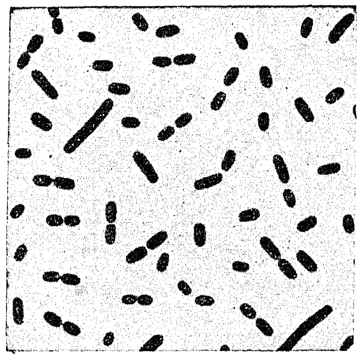


Fig. 162.—*Bacillus dysenteriae* Shiga from dextrose agar twenty-four hours old, stained with gentian violet. (Ford.)

6. *Period of communicability:* During the febrile period of the disease and until the micro-organism is absent from the bowel discharges, sometimes as long as four weeks.
7. *Susceptibility and immunity:* Susceptibility is general among children, but less so, and the disease less severe, in adults. A relative and not permanent immunity follows recovery from the disease.
8. *Prevalence:* Endemic, epidemic, and sporadic, but shares with other enteric infections in striking and progressive reduction wherever water supplies are rendered safe, sewage is disposed of in a sanitary manner, milk is pasteurized, and infant hygiene is of a good order. Most common in the summer months and in subtropical and tropical areas.
9. *Methods of control:*

   (*A*) The infected individual, contacts, and environment:

1. Recognition of the disease and reporting:[1] Clinical symptoms confirmed by serological and bacteriological tests.
2. Isolation: Infected individuals during the communicable period of the disease, particularly rigid personal precautions by attendants.
3. Concurrent disinfection: Bowel discharges.
4. Terminal disinfection: Cleaning.
5. Quarantine: None.
6. Immunization: Vaccines may give some immunity. Owing to severe reactions their use is not recommended, nor should vaccination be made compulsory except under extreme emergency.
7. Investigation of source of infection: Search for a common source in contaminated food and water, and for carriers particularly among food handlers, should be undertaken as in the case of typhoid fever.

(*B*) General measures:

1. **Protection and purification of public water supplies, together with prevention of subsequent contamination.**
2. **Pasteurization of public milk supplies; use of boiled milk for infant feeding.**
3. Supervision of preparation and handling of other foods, particularly those which are moist and eaten raw.
4. Hand washing, by food handlers in particular, following use of toilet.
5. Prevention of fly breeding; screening.
6. **Sanitary disposal of human excreta.**
7. Persons known to be infected, and their attendants, should be excluded from handling food for public consumption and from handling the family food supply if possible.
8. The exercise of rigid precautions in known cases of bacillary dysentery is requisite but is inadequate as a safeguard against the ever-present risk of infection from concealed sources. Reduction of high infant mortality rates is dependent upon prevention of diarrhea and enteritis. Infant hygiene, including breast feeding, scrupulous cleanliness at all times in the preparation and handling of food for children, and continuous attention to diet in order to avoid minor digestive disturbances that may lower resistance to the infection will do much toward accomplishing this aim. As a precautionary measure, all cases of infantile diarrhea should be regarded as bacillary dysentery. Prevention of epidemics of bacillary dysentery by guarding against massive dissemination of infection should be a major concern, particularly in prisons, camps, and institutions.

[1] Groups of cases of acute diarrheal disorder should always be reported to the health officer at once, even in the absence of exact determination of the nature and origin of the disease.

ENCEPHALITIS, INFECTIOUS, LETHARGIC AND NONLETHARGIC:

1. *Recognition of the disease:* Largely clinical. At least two forms occur: type A and type B. Type A is the more chronic and variable in course, often with a mild febrile onset, later with symptoms of brain or nerve involvement, such as slight meningeal irritation, somnolence, diplopia, or evident paralysis of eye muscles, insomnia, restlessness, twitching, myoclonia, catatonia, with or without fever; and still later at times, slow, semirigid movements, coarse tremor, masklike expression or other disturbances of motility, psychic or behavior disturbances, often with exacerbations and remissions over several years. Though an individual case of type B may be indistinguishable from type A, in type B the onset is usually more abrupt as to fever and headache, with drowsiness rather than deep sleep, disorientation, motor disturbances, but very infrequent paralysis of the eye muscles, meningeal irritation with an increase of cells in the spinal fluid more uniformly than in type A, and usually complete and fairly prompt recovery in the nonfatal cases. All ages are attacked in both types, children and young adults more frequently in type A, the older ages in type B. This disease is to be distinguished from post- or para-infectious encephalitis which follows or accompanies such infections as measles, vaccinia, and chickenpox, by the history of the prior infection.
2. *Etiological agent:* Probably a virus for type A; a specific filtrable virus for type B.
3. *Source of infection:* Probably discharges from the nose and throat of carriers or of infected persons, or articles freshly soiled therewith.
4. *Mode of transmission:* Probably by direct contact with a carrier or an infected person, or by contact with articles freshly soiled with the discharges of the nose and throat of such persons.
5. *Incubation period:* Four to twenty-one days.
6. *Period of communicability:* Unknown; cases rarely traceable to any previous case. Presumably at a maximum during acute febrile stage of the disease.
7. *Susceptibility and immunity:* Effective susceptibility limited to a small fraction of the population at any age. Natural immunity or immunity resulting from an attack is assumed to occur, but has not been proved except by the ability of the blood serum to neutralize type B virus.
8. *Prevalence:* Type A was first distinctly recognized in 1917, but had occurred before, and has since been prevalent in many parts of the world, especially from 1920 to 1926, infrequently now. Type B has been especially prevalent in the west central provinces of Japan, intense epidemics having occurred there in 1924 and 1929. At least some of the Japanese cases were distinct immunologically from the clinically similar type B cases in the St. Louis area in 1933, where there was an incidence of 100 per 100,000 population. Type A occurs at all seasons of the year but more frequently in late winter and spring. Type B occurs notably in late summer and fall epidemics.

9. *Methods of control:*
   (*A*) The infected individual, contacts, and environment:
      1. Recognition of the disease and reporting: Clinical symptoms, assisted, especially in type B, by microscopical and chemical examination of the spinal fluid if lumbar puncture is performed.
      2. Isolation: For one week after onset.
      3. Concurrent disinfection: Discharges of the nose and throat and articles soiled therewith.
      4. Terminal disinfection: None.
      5. Quarantine: None.
      6. Immunization: None.
      7. Investigation of source of infection: Search for prior cases in the community and for unreported cases among the associates of the patient may develop useful epidemiological information, but so far is of no practical value in control of the disease.

   (*B*) General measures: None.

FAVUS:

1. *Recognition of the disease:* A parasitic fungus disease of the skin usually on the scalp, marked by cup-shaped yellowish crusts covering the hair follicles.
2. *Etiological agent: Achorion schoenleinii* (Fig. 163).
3. *Source of infection:* Lesions of skin, particularly on scalp, rarely on nails.
4. *Mode of transmission:* Direct contact with patient, and indirectly through toilet articles.
5. *Incubation period:* Unknown.
6. *Period of communicability:* Until skin and scalp lesions are all healed as shown by absence of scaling and erythema, to be confirmed by microscopic examination, culture, and absence of fluorescence under a suitable ultraviolet light.
7. *Susceptibility and immunity:* Infection by this fungus is frequent with the presence of another patient in the family, and with neglect of personal cleanliness.
8. *Prevalence:* Rare in children in North America, and when occurring can usually be traced to immigrants from southern and eastern Europe.
9. *Methods of control:*
   (*A*) The infected individual, contacts, and environment:
      1. Recognition of the disease and reporting: Clinical symptoms, confirmed by microscopic examination of crusts, and cultures on Sabouraud's medium.
      2. Isolation: Exclusion of patient from school and other public places until lesions are healed. Patient should wear a light, tight-fitting cotton skull cap constantly. This must be changed frequently and boiled.
      3. Concurrent disinfection: Toilet articles of patient.
      4. Terminal disinfection: None.
      5. Quarantine: None.
      6. Immunization: None.

7. Investigation of source of infection: Search for unreported and unsuspected cases among immediate home or play or work associates of the patient.

(*B*) General measures:

1. Elimination of common utensils, such as hair brushes and combs.
2. Provision for adequate and intensive treatment and cure of cases of favus at hospitals and dispensaries, to abbreviate the period of infectivity of the patient.

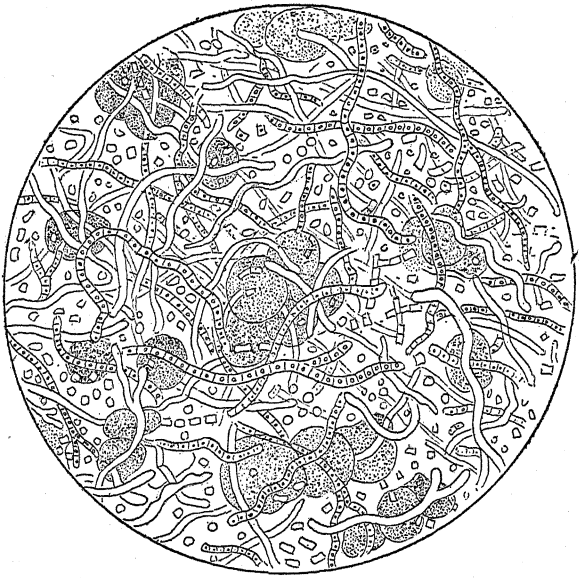


Fig. 163.—Favus fungus—*Achorion schoenleinii* (× about 700; partly diagrammatic). (Stelwagon and Gaskill.)

German Measles (Rubella):

1. *Recognition of the disease:* A febrile infection in epidemics, characterized by a polymorphous rash, sometimes resembling that of measles, sometimes that of scarlet fever, and sometimes of both at the same time; few or no constitutional symptoms but almost always enlargement of postauricular, suboccipital, and cervical, and occasionally of other, lymph nodes. Usually absence of leukocytosis.
2. *Etiological agent:* Unknown.
3. *Source of infection:* Secretions of the mouth and possibly of the nose.
4. *Mode of transmission:* By direct contact with the patient or with

articles freshly soiled with the discharges from the nose or throat of the patient.

5. *Incubation period:* From fourteen to twenty-one days; usually about sixteen days.
6. *Period of communicability:* From onset of catarrhal symptoms for at least four days, but not more than seven; the exact period is undetermined. Highly communicable.
7. *Susceptibility and immunity:* Susceptibility is general among young children. An attack usually confers permanent immunity.
8. *Prevalence:* Epidemic in expression, occurring mostly in childhood, but more in adults than is the case with measles. Commoner in urban than in rural communities, and oftener in winter and spring than at other seasons.
9. *Methods of control:*
   (*A*) The infected individual, contacts, and environment:
      1. Recognition of the disease and reporting: Clinical symptoms.
      2. Isolation: Separation of the patient from nonimmune children, and exclusion of the patient from school and public places for the period of presumed infectivity. Isolation rarely practicable.
      3. Concurrent disinfection: Discharges from the nose and throat of the patient and articles soiled by discharges.
      4. Terminal disinfection: Airing and cleaning.
      5. Quarantine: None.
      6. Immunization: None.
      7. Investigation of source of infection: Of no importance except to clarify doubts created by clinical difficulty in distinguishing this disease from scarlet fever in its early stages.

   (*B*) General measures: None.

GLANDERS:

1. *Recognition of the disease:* Occurs in two forms, one external, affecting the skin and known as "farcy," and an internal form known as "glanders." It may appear as an acute or chronic disease, with widely variable symptoms, the diagnosis being established by one or other of the following biological reactions: The complement fixation test, the mallein test, the agglutination test, or by nonspecific reactions, such as the Straus reaction, if confirmed by culture, or by identification of the *Pfeifferella mallei*, or by autopsy of the doubtful cases.
2. *Etiological agent:* Glanders bacillus, *Pfeifferella mallei* (Fig. 164).
3. *Source of infection:* Discharges from open lesions of mucous membranes, or of the skin of human or equine cases of the disease (*i. e.*, pus and mucus from the nose, throat, and bowel discharge from infected man and horse).
4. *Mode of transmission:* Contact with a case or with articles freshly soiled by discharges from a human or equine case.
5. *Incubation period:* Undetermined; usually one to five days.
6. *Period of communicability:* Until bacilli disappear from discharges or until lesions have healed.

7. *Susceptibility and immunity:* Susceptibility appears to be common. Immunity is believed to follow recovery from the infection.
8. *Prevalence:* Rare and sporadic and almost exclusively in men occupied about horses. In widespread and local epidemics as an epizootic in horses.
9. *Methods of control:*
   (*A*) The infected individual, contacts, and environment:
   1. Recognition of the disease and reporting.
   2. Isolation: Human case at home or hospital; for infected horses destruction rather than isolation is advised. **Skin contact with the lesions in the living or dead body is to be scrupulously avoided.**
   3. Concurrent disinfection: Discharges from human cases and articles soiled therewith.
   4. Terminal disinfection: Stable and contents where infected horses are found.

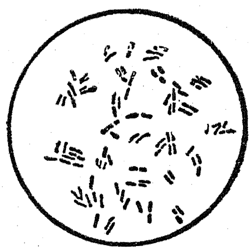


Fig. 164.—*Bacillus mallei,* the cause of glanders. (Lehmann and Neumann.)

   5. Quarantine of all horses in an infected stable until all have been tested by specific reaction, and the removal of infected horses and terminal disinfection of stable have been accomplished.
   6. Immunization: None of established value or generally accepted.
   7. Investigation of source of infection: Carriers not known in humans. Search for infected horses, especially in sales stables, by observation and specific laboratory tests.

   (*B*) General measures:
   1. **The abolition of common drinking trough for horses.**
   2. Sanitary supervision of stables and blacksmith shops.
   3. Semi-annual testing of all horses by a specific reaction where the disease is common.
   4. Testing of all horses offered for sale where the disease is common.

NOTE.—In this disease, as in all infectious or communicable diseases from which both animals and humans suffer, cases occurring in animals should be reported to the Department of Agriculture, and human cases should be reported to the Department of Health, reciprocal notification thereafter to be accomplished through official interdepartment channels.

GONORRHEA:

1. *Recognition of the disease:* Occurring initially as an infection of one of the mucous membranes, most frequently of the genital tract, urethra in the male, the vaginal or uterine mucosa in the female, the disease develops as an acute or chronic process in adjacent or remote tissues, among the latter especially as arthritis and endocarditis. Relapsing and chronic inflammatory discharging conditions at the site of original attack are common. Demonstration of the etiological agent in the lesions or discharges is the best and only certain diagnostic procedure. Specific antibodies may be demonstrated, and specific constitutional and local reactions can be provoked.
2. *Etiological agent:* Gonococcus, *Neisseria gonorrhoeae* (Fig. 165).
3. *Source of infection:* Discharges from lesions of inflamed mucous membranes and glands of infected persons, viz., urethral,

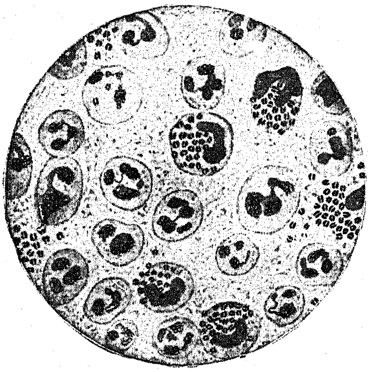


Fig. 165.—Pus from gonorrhea, showing gonococci. (Jakob.)

vaginal, cervical, conjunctival mucous membranes, and Bartholin's or Skene's glands in the female and Cowper's and the prostate glands in the male.
4. *Mode of transmission:* By direct personal contact with infected persons, and indirectly by contact with articles freshly soiled with the discharges of such persons. In adults by sexual intercourse; in children by other personal and indirect contact with discharges.
5. *Incubation period:* One to eight days, usually three to five days.
6. *Period of communicability:* As long as the gonococcus persists in any of the discharges, whether the infection be an old or a recent one. Readily communicated in sexual intercourse.
7. *Susceptibility and immunity:* Susceptibility appears to be general, particularly of vaginal tract in young girls, and of conjunctiva in newborn. Acquired immunity does not occur generally, but

some degree of transient local immunity may appear during infection. One attack and recovery does not protect against subsequent infection.

8. *Prevalence:* Widespread in both sexes and at all ages, but most common among men from eighteen to forty years of age and among women at a little earlier age. Endemic, sporadic, and epidemic.
9. *Methods of control:*
   (*A*) The infected individual, contacts, and environment:
   1. Recognition of the disease and reporting: Clinical symptoms, confirmed by bacteriological examination or serum reaction.
   2. Isolation: When the lesions are in the genito-urinary tract, exclusion from sexual contact, and when the lesions are conjunctival exclusion from school or contact with children, as long as the discharges contain the gonococcus.
   3. Concurrent disinfection: Discharges from lesions and articles soiled therewith.
   4. Terminal disinfection: None.
   5. Quarantine: None.
   6. Immunization: None.
   7. Investigation of source of infection: Each acute case should be traced to probable source of infection and appropriate control and treatment of this spreader of disease instituted. Males may continue to be carriers for a year or more; females for two to three years.

   (*B*) General measures:
   1. Provision of accurate and early diagnosis, and careful treatment of infected persons, with due consideration for privacy of record, consistent with effective control of the patient, search for source of infection, and provision for following cases until cured.
   2. Education in matters of sexual hygiene, particularly as to the fact that continence in both sexes at all ages is compatible with health and normal development.
   3. Repression of commercialized prostitution, and associated use of alcoholic beverages, by police or other competent authority.
   4. Restriction of advertising of services or medicines for the self-treatment of sex diseases, etc.
   5. Elimination of common towels and toilet articles from public places.
   6. Use of prophylactic silver solution in the eyes of the newborn.
   7. Personal prophylaxis should be advised to those who expose themselves to opportunity for infection, and made available for use immediately after sexual intercourse.
   8. Exclusion of persons in the communicable stage of the disease from occupations involving contact with children.

INFLUENZA:

1. *Recognition of the disease:* Whether occurring in a pandemic, in endemic-epidemic incidence, or as sporadic cases this disease is characterized in its typical form by sudden onset, fever of one to seven days' duration, accompanied by excessive prostration, aches and pains in back and limbs, coryza and bronchitis, and not uncommonly by pneumonia as a complication. During epidemics when such cases occur in large numbers and over a wide area, other cases of less distinctive type are found to be epidemiologically related to typical cases, and in these the diagnosis would not be made without such obvious association. The clinical criteria of influenza are quite indefinite, particularly in absence of widespread prevalence of the disease. Microscopic or other laboratory procedures are of no practical value in determining or excluding the diagnosis of influenza.
2. *Etiological agent:* A filtrable virus; associated often with various types of bacteria as secondary invaders.
3. *Source of infection:* Probably discharges from the mouth and nose of infected persons and articles freshly soiled by such discharges.
4. *Mode of transmission:* Believed to be by direct contact, by droplet infection, or by articles freshly soiled with discharges of the nose and throat of infected persons.
5. *Incubation period:* Short, usually twenty-four to seventy-two hours.
6. *Period of communicability:* Undetermined; possibly in prodromal as well as in the febrile stage and convalescent stages.
7. *Susceptibility and immunity:* Susceptibility is not general, for natural resistance or relative immunity appears to protect from one quarter to three quarters of persons intimately exposed to the disease even during widespread epidemics. Acquired immunity if it is actually developed by an attack of and recovery from the disease is of short duration (a few months) and of low grade, or perhaps only effective against a certain strain or strains of the virus.
8. *Prevalence:* Uncertain in pandemic, local epidemic, and sporadic, occurrence, by reason of indefinite clinical symptoms. In epidemics may affect up to 50 per cent of the population, especially at age groups between infancy and maturity. Commonly between December and May in North America. Occurs pandemically in cycles with intervals of several decades.
9. *Methods of control:*

   (*A*) The infected individual, contacts, and environment:

   1. Recognition of the disease and reporting: By clinical symptoms only. Uncertain in inter-epidemic periods.
   2. Isolation: During acute stage of the disease, especially in severe cases and those complicated by pneumonia.
   3. Concurrent disinfection: Discharges from the nose and throat of the patient.
   4. Terminal disinfection: None.
   5. Quarantine: None, but visiting should be discouraged.
   6. Immunization: None.

7. Investigation of source of infection: Of no practical value.

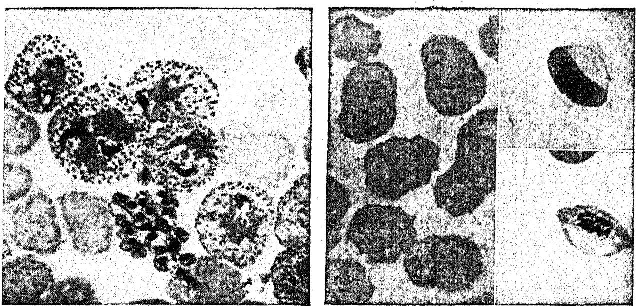
(*B*) General measures:

1. During epidemics efforts should be made to reduce opportunities for direct contact infection, as in crowded halls, stores, and street cars. Kissing, the use of common towels, glasses, eating utensils, or toilet articles should be avoided. In isolated towns and institutions infection has been delayed and sometimes avoided by strict exclusion of visitors from already infected communities. The closing of the public, parochial, and private schools has not been effective in checking the spread of infection. The judicious use of masks by nurses and other attendants may prove of value in preventing infection in hospitals. Scrupulous cleanliness of dishes and utensils used in preparing and serving food in public eating places should be required, including the subjection of such articles to disinfection in hot soapsuds. In groups which can be brought under daily professional inspection, the isolation of early and suspicious cases of respiratory tract inflammation, particularly when accompanied by a rise in temperature, may delay the spread of the disease. To minimize the severity of the disease, and to protect the patient from secondary infections and thus reduce mortality, **patients should go to bed at the beginning of an attack** and not return to work without the approval of their physician.
2. Crowding of beds in hospitals and institutions to accommodate increased numbers of patients and other inmates is to be especially avoided. Increased spacing between beds in wards and dormitories should be carried out to reduce the risk of attack, and of the occurrence of pneumonia.

MALARIA:

1. *Recognition of the disease:* A group of specific infectious fevers due to invasion of the red blood cells by one of at least three types of Sporozoa of the genus *Plasmodium.* These fevers occur endemically or epidemically and are associated with a symptom complex fairly characteristic of each variety, marked particularly by periodicity of fever and symptoms due to the growth and development of the organism. Enlargement of the spleen, secondary anemia, and the characteristic recurrence of chills and fever as clinical findings are confirmed by observing presence of the malaria parasites in blood film on microscopic examination. Mosquitoes of anopheline family are the only known vectors.
2. *Etiological agent:* The several species of micro-organisms: *Plasmodium vivax* (tertian), *Plasmodium malariae* (quartan), *Plasmodium falciparum* (aestivo-autumnal) (Fig. 166).
3. *Source of infection:* The blood of an infected individual.

4. *Mode of transmission:* By bite of the infected *Anopheles* mosquitoes. The mosquito is infected by biting an individual suffering from acute or chronic malaria. The parasite develops in the body of the mosquito for from ten to fourteen days (twenty-one days for quartan), after which time the sporozoites appear in its salivary glands.
5. *Incubation period:* Varies with the type of species of infecting micro-organism and the amount of infection, usually fourteen days in the tertian variety.
6. *Period of communicability:* As long as the sexual form of the malaria micro-organism exists in the circulating blood in sufficient quantities to infect mosquitoes. In untreated cases this may last for months.



A B

Fig. 166.—A, Half-grown tertian malarial parasites in stippled cells and a group of spores from a freshly ruptured segmenter. From a slide of double tertian malaria concentrated by F. M. Johns. B, Aestivo-autumnal malarial parasites, small ring forms and crescents. The different forms of malaria are due to the different varieties of malarial parasites. (Todd and Sanford.)

7. *Susceptibility and immunity:* Susceptibility is universal, although Negroes appear to suffer less severely from the disease. Some relative immunity appears to follow repeated attacks of the disease. A state of good nutrition is believed to be a factor in maintaining resistance to the disease and in spontaneous recovery.
8. *Prevalence:* Endemic and sporadic, more frequently among children than adults, among Negroes more than among whites. Particularly prevalent in the southeast coastal plain, Mississippi Valley, south of St. Louis, in eastern Texas, New Mexico, Louisiana, Arkansas, southern Missouri, and slightly in California and Oregon. Serious in Puerto Rico and the Philippines. Seasonal occurrence of tertain type in early summer, aestivo-autumnal in early fall.
9. *Methods of control:*

(*A*) The infected individual, contacts, and environment:

1. Recognition of the disease and reporting: Clinical symptoms always to be confirmed by microscopical examination of the blood. Repeated examination of blood films may be necessary.
2. Isolation: The individual with malarial parasites in his blood should be protected from the bites of mosquitoes. With the exception of this simple precaution, isolation and quarantine are of no avail.
3. Concurrent disinfection: None. Destruction of *Anopheles* mosquitoes in the sick room.
4. Terminal disinfection: Destruction of *Anopheles* mosquitoes in the sick room.
5. Quarantine: None.
6. Immunization: None: The administration of prophylactic doses of quinine should be insisted on for those constantly exposed to infection and unable to protect themselves against *Anopheles* mosquitoes. This is not in an exact sense prophylaxis but early therapeusis.
7. **Specific therapy: Quinine bisulfate is preferred for routine treatment and "atebrin" is found by some to be equally reliable. Plasmochin seems to be specific for destruction of the adult sexual form of the parasite in aestivo-autumnal malaria and in conjunction with quinine for tertian and quartan infections.**
8. Investigation of source of infection: Breeding places and house infestation by *Anopheles* mosquitoes should be sought for and larvae and mosquitoes destroyed when and where possible. Carriers of the malarial micro-organism, untreated, or inadequately treated, should be sought and brought under systematic therapy until the micro-organism can no longer be found in their blood.

(*B*) General measures:

1. **Employment of known measures for destroying larvae of anophelines and the eradication of breeding places of such mosquitoes.**
2. Blood examination of persons living in infected centers to determine the incidence of infection.
3. **Screening sleeping and living quarters; use of mosquito nets.**
4. Killing mosquitoes in living quarters.
5. Education of the public as to the mode of spread and methods of prevention of malaria.

MEASLES:

1. *Recognition of the disease:* Clinical characteristics are fever, catarrhal symptoms in eyes and nose and throat in the prodromal stage, as well as at the height of the disease, an early eruption in the mouth, Koplik spots, later an exanthem and enanthem, and a branny desquamation during convalescence. When the disease is prevalent, or a susceptible child has been exposed to a case of measles, the diagnosis should be suspected on appear-

ance of the fever and catarrhal symptoms, without waiting for confirmatory eruptions, and isolation precautions should be instituted at once.

2. *Etiological agent:* A specific filtrable virus.
3. *Source of infection:* Buccal and nasal secretions of an infected individual.
4. *Mode of transmission:* Directly from person to person; indirectly through articles freshly soiled with the buccal and nasal discharges of an infected individual. The most easily transmitted of the communicable diseases.
5. *Incubation period:* About eight to ten days from date of exposure to onset of fever; twelve to fourteen days to appearance of rash; rarely as long as eighteen days. When convalescent serum has been used, but too late to prevent infection, the incubation period may be as long as twenty-one days.
6. *Period of communicability:* During the period of catarrhal symptoms and until the cessation of abnormal mucous membrane secretions—minimum period of nine days; from four days before to five days after the appearance of the rash.
7. *Susceptibility and immunity:* All persons must be considered susceptible until they have had the disease, except that most babies born of mothers who have had the disease are immune for the first six months of life. Natural immunity may last into adult life in rare instances. Acquired immunity is usual after recovery from an attack. Passive immunity may be established for a few weeks, but not more than four, by the use of 4 to 10 cc. of convalescent measles serum or 20 to 50 cc. of whole blood of immunes, or if citrated blood is used, 25 to 60 cc.
8. *Prevalence:* Universal. Probably 80 to 90 per cent of all persons surviving to the twentieth year of life have had an attack, and rarely does a person go through life without having had measles. Occurs most commonly in children between five to fourteen years of age, but many cases are in children under five. Endemic in large population units. In remote or insular groups epidemics occur on contact with a case in a visitor. Highest incidence from March to June in North America. Frequency of epidemics depends on size of community, or proximity to a large center, amount of communication between large and small population groups, accretion of population by births and other less exactly determined factors. Much more likely to result in death from complicating pneumonia in children under two than at higher ages.
9. *Methods of control:*

   (*A*) The infected individual, contacts, and environment:

   1. Recognition of the disease and reporting: Clinical symptoms. Special attention to rise of temperature. Koplik spots and catarrhal symptoms in exposed individuals.
   2. Isolation: During period of communicability for the sake of the patient as well as others.
   3. Concurrent disinfection: All articles soiled with the secretions of the nose and throat.
   4. Terminal disinfection: Thorough cleaning.

5. Quarantine: When the disease is very prevalent and in large communities, quarantine of exposed susceptible children may be impracticable and of no value. Exclusion of exposed susceptible school children and teachers from school until fourteen days from last exposure may be justifiable under other conditions. This applies to exposure in the household. Exclusion of exposed susceptible children from all public gatherings for the same period. If the date of only exposure is reasonably certain, an exposed susceptible child of school age may be allowed to attend school for the first seven days of the incubation period. Quarantining of institutions of young children and of wards or dormitories where exposure is suspected is of some value. Strict quarantine of wards of infants if a case occurs in an institution is important.
6. Immunization: By the use of the serum or whole blood of convalescent patients, or of any healthy adults who have had measles, given within five days after exposure to a known case of measles, the attack in the exposed person may be averted in a high percentage of instances; if not averted, the disease is modified. Given later, but at a time prior to the clinical onset of the disease, convalescent serum usually modifies the severity of the attack and the patient probably acquires the usual lasting immunity to the disease.
7. Investigation of source of infection: Search for exposed susceptible children under three years of age is profitable. Carriers are not known to occur. Every effort should be made to have all cases reported early in the disease by the physician, or, if there is none in attendance, by parent or guardian. The chief object of discovering cases is to assure suitable care for little children and immunization if practicable of those exposed under five years of age.

(*B*) General measures:

1. Daily examination of exposed children and of other possibly exposed persons. This examination should include record of the body temperature. A non-immune exposed individual exhibiting a rise of temperature of 0.5° C. or more should be promptly isolated pending diagnosis.
2. Schools should not be closed or classes discontinued where daily observation of the children by physician and nurse is provided for.
3. Education as to special danger of exposing young children to those exhibiting fever and acute catarrhal symptoms of any kind, particularly during years and seasons of epidemic prevalence of measles.
4. In institutional outbreaks, immunization with con-

valescent serum of all minor inmates who have not had measles is of value in checking the spread of infection and in reducing mortality. No new admissions and no visitors under sixteen years of age should be permitted in an institution for children, during a measles outbreak in the community or in the institution.

5. The immunization of infants and children under three years of age with convalescent serum or whole adult blood in families where cases of measles occur in older children or adults should be encouraged by the department of health and by private physicians.

MENINGOCOCCUS MENINGITIS:

1. *Recognition of the disease:* An acute infectious disease with sudden onset, fever, headache, nausea, rigidity of neck, and in epidemics not infrequently petechial spots on the skin. The specific micro-organism in one of its several types may in some cases be found in the early stages by blood culture, and usually during the course of the disease in the spinal fluid, and in the discharges of the retronasal surfaces. The disease occurs in epidemic and sporadic manner.
2. *Etiological agent:* Meningococcus; *Neisseria intracellularis* (Fig. 167).

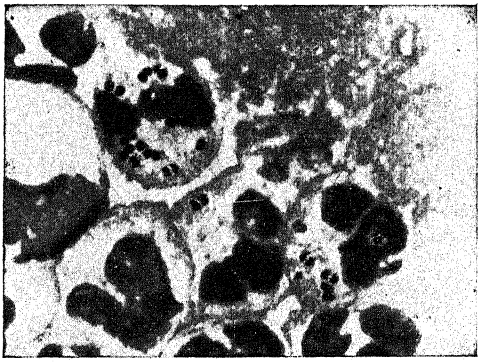


Fig. 167.—Meningococci in cerebrospinal fluid from a case of epidemic spinal meningitis. Note the cocci within the cytoplasm of leukocytes. Gram's method and carbolfuchsin (photograph × 1500). (Todd and Sanford.)

3. *Source of infection:* Discharges from the nose and mouth of infected persons. Clinically recovered cases, and healthy persons not known to have had the disease but recently in contact with cases or other carriers may act as carriers and are commonly found, especially during epidemics. Such healthy carriers are found independent of epidemic prevalence of the disease, even up to 5 to 10 per cent of a general population.

4. *Mode of transmission:* By direct contact with infected persons and carriers and indirectly by contact with articles freshly soiled with the nasal and mouth discharges of such persons.
5. *Incubation period:* Two to ten days, commonly seven; tends to be short in epidemics; in rare instances the period may be longer when a carrier develops the disease.
6. *Period of communicability:* During the clinical course of the disease and until the specific micro-organism is no longer present in the nasal and mouth discharges of the patient, about two weeks. The same applies to healthy carriers so far as affects persistence of infectious discharges. Readily communicable in crowded living conditions among persons of lowered resistance.
7. *Susceptibility and immunity:* Susceptibility is limited. Acquired immunity from having had the disease, apart from immediate clinical relapses, may be of long duration but is uncertain. There is no artificial immunity. Resistance to infection appears to be low when those exposed to crowded conditions of living are also fatigued and ill fed.
8. *Prevalence:* Usually low incidence of sporadic cases. Within a community in epidemics at long but irregular intervals. The cases are mostly in children under ten years of age and in young adults, but occur at all ages. Local epidemics commonly related to chronic or emergency overcrowding of living quarters, as in ships, barracks, and lodging houses or slums, and usually in the winter or spring. No limitations in geographical distribution.
9. *Methods of control:*
   (*A*) The infected individual, contacts, and environment:
      1. Recognition of the disease and reporting: Clinical symptoms confirmed by the microscopic and bacteriological examination of the spinal fluid, and by bacteriological examination of nasal and pharyngeal secretions.
      2. Isolation of infected persons until fourteen days after onset of the disease or until negative swabs are obtained from the nasopharynx.
      3. Concurrent disinfection: Of discharges from the nose and mouth or articles soiled therewith.
      4. Terminal disinfection: Cleaning.
      5. Quarantine: None.
      6. Immunization: None.
      7. Investigation of source of infection: Impracticable.

   (*B*) General measures:
      1. Education as to personal cleanliness and necessity of avoiding contact and droplet infection.
      2. Prevention of overcrowding such as is common in living quarters, transportation conveyances, working places, and especially in barracks, camps, and ships.

   (*C*) Epidemic measures:
      1. **Increase the separation of individuals and the ventilation in living and sleeping quarters for such groups of people as are especially exposed to infection because of their occupation or some necessity of living**

conditions. Chilling, bodily fatigue, and strain should be minimized for those especially exposed to infection.

MUMPS:

1. *Recognition of the disease:* Acute specific infection characterized by fever, swelling, and tenderness of the salivary glands, usually of the parotid, sometimes of the sublingual or submaxillary glands. Metastases occur sometimes in the ovaries and testicles. Epidemic occurrence is usual, especially in schools, colleges, and barracks, of new recruits. Inflammation of Stenson's duct may assist in early diagnosis. There are no laboratory aids of value.
2. *Etiological agent:* A specific filtrable virus.
3. *Source of infection:* Secretions of the mouth and possibly of the nose.
4. *Mode of transmission:* By direct contact with an infected person or with articles freshly soiled with the discharges from the nose and throat of such infected persons.
5. *Incubation period:* From twelve to twenty-six days. The most common period eighteen days, accepted as usual. A period of twenty-one days is not uncommon.
6. *Period of communicability:* Unknown, but assumed to persist until the parotid gland has returned to its normal size.
7. *Susceptibility and immunity:* Susceptibility believed to be general. Immunity follows an attack but second attacks of the disease are not rare. Brief passive immunity may follow inoculation with convalescent serum or whole blood.
8. *Prevalence:* This disease is decidedly less prevalent than the other common communicable diseases of childhood such as measles, whooping cough, and chickenpox. Winter and spring are the seasons of greatest prevalence. Its occurrence is sporadic and epidemic except in large cities, where it is endemic.
9. *Methods of control:*

   (*A*) The infected individual, contacts, and environment:

   1. Recognition of the disease and reporting: The diagnosis is usually made on swelling of the parotid gland.
   2. Isolation: Separation of the patient from nonimmune children and young children and young people and exclusion of the patient from school and public places for the period of presumed infectivity, particularly when the disease appears in children's institutions or among young recruits.
   3. Concurrent disinfection: All articles soiled with the discharges of nose and throat of the patient.
   4. Terminal disinfection: None.
   5. Quarantine: None. Exposed susceptible persons should be regularly inspected for the onset, the presence of initial symptoms of the disease, such as fever, or swelling or pain of the parotid, or submaxillary glands, for three weeks from the date of last exposure. Exposed children medically certified as having had the disease should not be excluded from school as susceptibles.

6. Immunization: None. Passive temporary immunity by convalescent serum or blood still in experimental stage.
7. Investigation of source of infection: Search for unreported or recent cases among associates of the patient in school or family or other group of young people. Carriers are not known to occur.

(*B*) General measures: None.

PARATYPHOID FEVER:

1. *Recognition of the disease:* A general infection with the paratyphoid bacillus characterized especially by continued fever and involvement of the lymphoid tissues of the intestines, enlargement of the spleen, and a variety of constitutional symptoms, sometimes rose spots on the trunk, usually diarrheal disturbance. The infecting micro-organism may be found in the feces, blood, and urine.
2. *Etiological agent:* Paratyphoid bacillus A (Fig. 168), B, or C; *Salmonella paratyphi; Salmonella schottmülleri.*

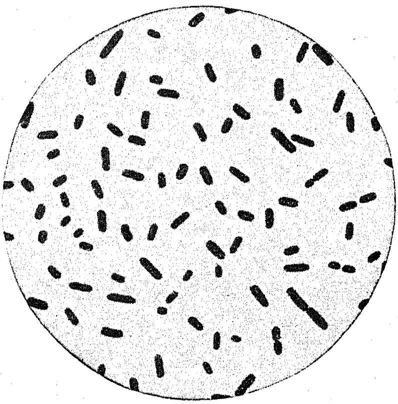


Fig. 168.—*Bacillus paratyphosus A* from twenty-hour culture on dextrose agar, stained with gentian violet. (Ford.)

3. *Source of infection:* Bowel discharges and urine of infected persons, and water or foods contaminated with such discharges of infected persons or of healthy carriers. Healthy carriers may be numerous in an outbreak.
4. *Mode of transmission:* Directly by personal contact; indirectly by contact with articles freshly soiled with the discharges of infected persons or through milk, water, or food contaminated by such discharges, probably by flies.
5. *Incubation period:* Four to ten days; average, seven days.
6. *Period of communicability:* From the appearance of prodromal symptoms, throughout the illness and relapses, during con-

valescence, and until repeated bacteriological examination of discharges shows absence of the infecting organism.

7. *Susceptibility and immunity:* Susceptibility is general. Natural immunity probably exists in some adults. Acquired immunity is usually permanent after recovery from the disease. Artificial active immunity of probably two years' duration can be developed by the use of vaccines.
8. *Prevalence:* Frequency has fallen with that of typhoid fever until in most parts of North America it is relatively rare, occurring sporadically or in small local carrier or contact epidemics. Probably nowhere endemic in North America.
9. *Methods of control:*

(*A*) The infected individual, contacts, and environment:

1. Recognition of the disease and reporting: Clinical symptoms confirmed by specific agglutination test, or by bacteriological examination of blood, bowel discharges, or urine.
2. Isolation: In fly-proof room, preferably under hospital conditions, of such cases as cannot command adequate sanitary environment and nursing care in their homes.
3. **Concurrent disinfection: Disinfection of all bowel and urinary discharges and articles soiled with them.**
4. Terminal disinfection: Cleaning.
5. Quarantine: None.
6. Immunization: Of exposed susceptibles.
7. Investigation of source of infection: Search for common source in polluted water, milk, shellfish or other food, and individual sources as unreported cases and carriers.

(*B*) General measures:

1. **Protection and purification of public water supplies.**
2. **Pasteurization of public milk supplies.**
3. Limitation of collection and marketing of shellfish to those from approved sources.
4. Supervision of other food supplies, and of food handlers.
5. Prevention of fly breeding.
6. **Sanitary disposal of human excreta.**
7. Extension of immunization by vaccination to persons especially subject to exposure by reason of occupation and travel, to those living in areas of high endemic incidence of typhoid fever, and to those for whom the procedure can be systematically and economically applied, as military forces and institutional populations, depending on prevalence of the disease.
8. Discovery and supervision of paratyphoid carriers and their exclusion from the handling of foods.
9. Exclusion of suspected milk supplies on epidemiological evidence pending discovery and elimination of the personal or other cause of contamination of the milk.

10. Exclusion of suspected water supplies until adequate protection or purification is provided unless all water used for toilet, cooking, and drinking purposes is boiled before use.

PNEUMONIA, ACUTE LOBAR:

1. *Recognition of the disease:* An acute infection characterized by sudden onset with chill followed by fever, often pain in the chest, usually cough and dyspnea. In many cases in children, vomiting and convulsions occur at the onset. Determination of the infecting micro-organism by microscopic and cultural examination of the sputum is useful as an aid in therapy and for epidemiological studies. The *x*-ray may disclose pulmonary lesions before the stethoscope.
2. *Etiological agent:* Various pathogenic bacteria commonly found in the nose, throat and mouth, such as the pneumococcus (Fig. 169) in about 95 per cent of the cases, and of these, 50 per cent types I and II; the bacillus of Friedländer; in occasional cases, the hemolytic streptococcus; the influenza bacillus, etc.

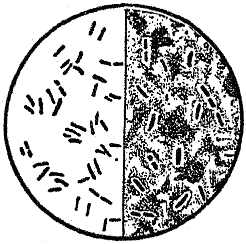


Fig. 169.—*Bacillus pneumoniae,* often appear arranged in pairs. (Lehmann and Neumann.)

3. *Source of infection:* Probably discharges from the mouth and nose of infected person or carrier and articles freshly soiled with such discharges. Except when already attacked by some respiratory infection, exposed individuals rarely develop pneumonia as a result of transmission of infection by direct or indirect means from the patient.
4. *Mode of transmission:* By direct contact with infected person or carrier, or with articles freshly soiled with the discharges of the nose and throat of such persons, and possibly from infected dust of rooms occupied by infected persons.
5. *Incubation period:* Believed to be short, usually one to three days—not well determined.
6. *Period of communicability:* Unknown; presumably until the discharges of the mouth and nose no longer carry the infectious agent in an abundant amount or in a virulent form.
7. *Susceptibility and immunity:* Susceptibility is general, accentuated by wet and cold and exposure, and apparently under certain conditions by bodily and mental fatigue, and by alcoholism.

Natural immunity may occur, but is doubtful. Acquired immunity to the particular micro-organism may follow an attack of pneumonia; such immunity is of short duration. Artificial active or passive immunity cannot be relied upon.

8. *Prevalence:* Common, and affecting at one time or other, between adolescence and old age, a large proportion of the population. No race or color or either sex is exempt from likelihood of having this disease. Occurs in all climates and seasons, but most often in winter and spring and in regions where cold, windy, changeable, and inclement weather prevails.
9. *Methods of control:*
   (*A*) The infected individual, contacts, and environment:
      1. Recognition of the disease and reporting: Clinical symptoms. Specific infecting organisms may be determined by serological and bacteriological tests early in the course of the disease, which may give basis for epidemiological studies and for specific serum therapy.
      2. Isolation: Medical aseptic technic, preferably at home.
      3. Concurrent disinfection: Discharges from the nose and throat of the patient.
      4. Terminal disinfection: Thorough cleaning and airing.
      5. Quarantine: None.
      6. Immunization: None.

   (*B*) General measures:
      1. Whenever practicable and particularly in institutions, barracks, and on shipboard, crowding in living and sleeping places should be avoided. The general resistance should be conserved by good food, fresh air, sufficient sleep, temperance in the use of alcoholic beverages, and other hygienic measures.

POLIOMYELITIS:

1. *Recognition of the disease:* An acute infection with moderate initial fever, usually headache and gastro-intestinal symptoms such as vomiting and constipation, drowsiness alternating with irritability, hyperesthesia, stiffness of neck and spine, usually accompanied by an increase in pressure and in the number of cells in the spinal fluid, tremor, and exaggeration of the muscular reflexes. Later, local diminution of reflexes and local motor weakness (paralytic). Any of these symptoms may be absent, but the diagnosis of the cases which are not at some time paralytic is so frequently uncertain that only paralytic cases should be counted officially as poliomyelitis, due precautions being taken in the others. Paralysis may be sudden and cause death within a few hours of onset by cessation of respiration without clear-cut symptoms. There is a marked tendency for the paralysis to improve after it has reached its height.
2. *Etiological agent:* A specific filtrable virus.
3. *Source of infection:* Nose and throat discharges of infected persons and carriers, or articles recently soiled therewith. Unpasteurized milk is a rare source of infection.
4. *Mode of transmission:* The virus enters the brain by way of the olfactory nerves and bulb when introduced into the nose or

nasopharynx of a susceptible person, presumably from a carrier in most instances.

5. *Incubation period:* Commonly seven to fourteen days.
6. *Period of communicability:* Not definitely known, but apparently covered by the latter part of the incubation period and the first week or two of the disease—possibly much longer in a very few cases, but cases are not as a rule directly traceable to any previous case.
7. *Susceptibility and immunity:* Infants born of immune mothers are believed to retain their immunity for about one year. Children are more frequently susceptible than adults except in extremely isolated communities not previously reached by the infection. Immunity is usually high among adults who have lived in large cities, less among those in rural sections. An attack of the disease gives permanent immunity as a rule, although second attacks have been observed.
8. *Prevalence:* Infection occurs practically throughout the world, but cases are most frequent in the cooler part of the temperate zone, occurring both sporadically and in epidemics at irregular intervals, with the highest incidence in late summer and fall. Ten cases per 100,000 population per year is an ordinary incidence.
9. *Methods of control:*

   (*A*) Infected individual, contacts, and environment:

   1. Recognition of the disease and reporting: Clinical symptoms, assisted by microscopical and chemical examination of the spinal fluid if lumbar puncture is performed.
   2. Isolation: For two weeks from onset. Almost invariably the period of restriction of visitors and care in bed desirable for the patient extends beyond the period of presumed communicability of the disease.
   3. Concurrent disinfection: Nose and throat discharges and articles soiled therewith.
   4. Terminal disinfection: None.
   5. Quarantine: Exposed children of the household of school age are to be kept from school, and adults of the household whose vocations bring them into contact with children or with food to be eaten uncooked are to be kept from such vocation for fourteen days from last exposure to recognized case.
   6. Immunization: None.
   7. Investigation of source of infection: Search for and expert diagnosis of sick children to locate unrecognized and unreported cases of the disease.

   (*B*) General measures during epidemics:

   1. General warning to physicians and the laity of the prevalence or increase of incidence of the disease, description of usual characteristics of onset, and necessity for diagnosis and medical care, particularly for bed rest of patients and protection of their muscles.
   2. All children with fever should be isolated pending diagnosis.

3. Education in such technic of bedside nursing as will prevent distribution of infected discharges to others from cases isolated at home.
4. Protection of children so far as practicable against unnecessary contact with other persons, especially those outside their own homes, during epidemic prevalence of the disease.
5. Avoidance of unnecessary physical strain in children during an epidemic or in case of known exposure.

RABIES:

1. *Recognition of the disease:* In the human being this acute, specific, rapidly fatal infection may not be recognized until a spasm of deglutition appears, unless the earlier and mild constitutional symptoms such as an expression of anxiety, paresthesias especially in or near the wound, and some paralysis have been looked for after the bite of a rabid animal. In the dog or other animal, recognizable symptoms are any unexplained change in behavior followed by excitability or paralysis, and death within ten days of onset of symptoms. Verification of cause of death may be established by discovery of Negri bodies in nerve cells of brain or cord, or by animal inoculation.
2. *Etiological agent:* A specific filtrable virus.
3. *Source of infection:* Saliva of infected animals, chiefly dogs.
4. *Mode of transmission:* Inoculation of denuded tissue with saliva of infected animals, almost always by bites.
5. *Incubation period:* Usually two to six weeks. May be prolonged to six months or even longer. Duration depends on virulence of saliva and on site of wound in relation to richness of nerve supply and directness of nerve path to brain.
6. *Period of communicability:* For fifteen days in the dog before the onset of clinical symptoms and throughout the clinical course of the disease. Only slightly communicable in man.
7. *Susceptibility and immunity:* Susceptibility general. Natural immunity is not known to exist in man or among the animals subject to the disease. Prophylactic antirabic treatment of infected humans will prevent development of the disease, with rare exceptions, if the treatment is begun soon after the injury and the site of the wound is not extensive in the distribution of the facial nerve.
8. *Prevalence:* Rare in man; more likely to occur in males than females and most often in persons under twenty years of age. World-wide distribution. Universally fatal in developed human cases. More prevalent among dogs and sometimes in wild carnivorous animals.
9. *Methods of control:*

   (*A*) The infected individual, contacts, and environment:

   1. Recognition of the disease and reporting: Clinical symptoms, confirmed by the presence of Negri bodies in the brain of the animal which has caused the injury, and by animal inoculations with material from the brain of such animal.
   2. Isolation: None if the patient is under adequate medical supervision, and the immediate attendants

are warned of possibility of inoculation by human virus.

3. Concurrent disinfection of saliva of patient and articles soiled therewith.
4. Terminal disinfection: Thorough cleaning.
5. Quarantine: None.
6. Immunization: Preventive vaccination of the patient after exposure to infection by inoculation.
7. Investigation of source of infection: Search for the rabid animal and for any animals bitten by it. Carriers in animals are not known to occur.

(*B*) General measures:

1. Detention and examination of dogs suspected of having rabies.
2. Immediate antirabic treatment of people bitten by dogs or by other animals suspected or known to have rabies, unless the animal is proved not to be rabid by subsequent observation or by microscopic examination of the brain and cord. The wound caused by any bite of a rabid animal should be treated at once to the depths with fuming nitric acid, with complete protection of the eye in the case of face bites.
3. Education in the care of dogs, especially directed to dog owners and the police, including advice against shooting of rabid or suspected animals in the head lest the laboratory examination of the brain be rendered difficult or impossible. Dog owners should be impressed with the serious implications of keeping dogs in densely built up cities.
4. **Control of dog population by requiring annual license, provision for the impounding and the humane destruction of all unlicensed dogs, quarantine of all dogs in areas where rabid animals have run at large.**

SCARLET FEVER:

1. *Recognition of the disease:* Sudden onset with nausea, vomiting, fever, and sore throat; rash (bright red spots on subcuticular flush) on second or third day. Cases occur without eruption, when provisional diagnosis may be made on sore throat, fever, vomiting, and history of exposure. The Schultz-Charlton blanching phenomenon may be used when rash has recently appeared: $\frac{1}{10}$ to $\frac{1}{2}$ cc. convalescent serum or scarlet fever antitoxin is injected into skin where rash exists, which causes local blanching in six to thirty-six hours if rash is scarlatinal; absence of blanching, however, does not rule out scarlet fever.
2. *Etiological agent:* A hemolytic streptococcus.
3. *Source of infection:* Discharges from the nose, throat, ears, abscesses, or wound surfaces of sick or convalescent patients, and articles freshly soiled therewith. The nose and throat discharges of carriers may also spread the disease.
4. *Mode of transmission:* Directly by contact with an infected person, indirectly by articles freshly soiled with discharges of an in-

fected person, or through contaminated milk or milk products, not by skin desquamation.

5. *Incubation period:* Two to seven days, usually three to four days.
6. *Period of communicability:* Usually until three weeks from the onset of the disease, without regard to the stage or extent of desquamation, but until all abnormal discharges have ceased and all open sores or wounds have healed. Adults convalescent from scarlet fever appear to be less likely to transmit infection than are children. The infectious agent is more likely to be transmitted in colder seasons of the year.
7. *Susceptibility and immunity:* Susceptibility is not general, particularly among adults. Unnoticed infections occur and produce immunity. Lasting immunity is usual after an attack, but not invariable, as second attacks occur. Artificial passive immunity of a few weeks may be developed by human convalescent serum. Artificial active immunity of uncertain duration can be developed in a considerable proportion of susceptible persons by the use of a suitable streptococcus antigen.
8. *Prevalence:* Found in all parts of the world but unimportant in tropics and of low incidence in subtropical areas of North America. Commoner in urban than in rural areas. In cities about 80 per cent of the cases occur in children under ten, and 60 per cent in those under five years of age. Most common in winter and spring.
9. *Methods of control:*

(*A*) The infected individual, contacts, and environment:

1. Recognition of the disease and reporting: By clinical symptoms.
2. **Isolation: In home or hospital, maintained in each case until the end of the period of communicability. If medical inspection is not available, isolation for twenty-one days from onset for uncomplicated cases.**
3. Concurrent disinfection: Of all articles which have been in contact with a patient and all articles soiled with discharges of the patient.
4. Terminal disinfection: Thorough cleaning.
5. Quarantine: Exclusion of exposed children and teachers from association with children, and food handlers from their work, until seven days have elapsed since last exposure to a recognized case.
6. Immunization: Exposed susceptibles, as determined by the Dick test, may be passively immunized by convalescent scarlet fever serum or scarlet fever antitoxin, under special circumstances.
7. Investigation of source of infection: Search for individual source in contact cases or carrier, and in unpasteurized milk and milk products. It is important to discover undetected cases and convalescent and contact carriers.

(*B*) General measures:

1. Daily examination of exposed children and of other possibly exposed persons for a week after last ex-

posure. Encourage removal of young susceptible contacts in the family to homes of adult friends for duration of communicable stage in the patient.

2. Schools should not be closed where daily observation of the children by a physician or nurse can be provided for.
3. In school and institutional outbreaks immunization of all exposed children with scarlet fever toxin may be advisable.
4. In the presence of a sharp outbreak, modified isolation of persons with sore throat or upper respiratory tract infection, at least through the clinically active stage, particularly if exposure to scarlet fever patients be determined.
5. Education as to special danger of exposing young children to those exhibiting acute catarrhal symptoms of any kind.
6. Pasteurization of milk supply.

Septic Sore Throat:

1. *Recognition of the disease:* Acute sore throat appearing in epidemic outbreaks, often of a highly virulent character, and accompanied by various general septicemic manifestations. The onset is likely to be abrupt with chill, high temperature, and vomiting.
2. *Etiological agent:* Streptococcus (hemolytic type).
3. *Source of infection:* The human nasopharynx, usually the tonsils, any case of acute streptococcus inflammation of these structures being a potential source of infection, including the period of convalescence of such cases. The udder of a cow infected by the milker is a common source of infection. In such udders the physical signs of mastitis may be absent.
4. *Mode of transmission:* Direct or indirect human contact; consumption of raw milk contaminated by case or carrier or from an infected udder.
5. *Incubation period:* One to three days.
6. *Period of communicability:* In man, presumably during the continuance of clinical symptoms; in the cow, during the continuance of discharge of the streptococci in the milk, the condition in the udder tending to a spontaneous subsidence. The carrier stage may follow convalescence and persist for some time.
7. *Susceptibility and immunity:* Susceptibility general, but somewhat less, in young children. Immunity, either natural or acquired, is rare and uncertain, if it occurs at all.
8. *Prevalence:* Usually in epidemics, in any geographic area except where milk supply is pasteurized. Most cases in adolescents and adult milk drinkers. Most often in spring and early summer, but may occur at any season.
9. *Methods of control:*

   (*A*) The infected individual, contacts, and environment:

   1. Recognition of the disease and reporting: Clinical symptoms. Bacteriological examination of the lesions or discharges from the tonsils and nasopharynx may be useful.

2. Isolation: During the clinical course of the disease and convalescence, and particularly exclusion of the patient from participation in the production or handling of milk or milk products.
3. Concurrent disinfection: Articles soiled with discharges from the nose and throat of the patient.
4. Terminal disinfection: Cleaning.
5. Quarantine: None.
6. Immunization: None.
7. Investigation of source of infection: Search for cases and carriers among milkers and other handlers of unpasteurized milk, and for mastitis in milk cows.

(*B*) General measures:

1. Exclusion of suspected milk supply from public sale or use until pasteurized. The exclusion of the milk of an infected cow or cows in small herds is possible when based on bacteriological examination of the milk of each cow, and preferably the milk from each quarter of the udder at frequent intervals. Exclusion of human cases or carriers from handling milk or milk products.
2. **Pasteurization of all milk.**
3. Education in the principles of personal hygiene and avoidance of the use of common towel, drinking and eating utensils.
4. In the absence of an epidemic, the milk of any cow with evidence of mastitis should be excluded from sale or use as a protection in addition to pasteurization.

SMALLPOX:

1. *Recognition of the disease:* One to five days of febrile symptoms before the eruption, which is papular for one to four days, vesicular for one to four days and pustular for two to six days, forming crusts which fall off ten to forty days after the first sign of the lesions, and leave pink scars which fade gradually.

   Unless scanty, the eruption is symmetrical and general, more profuse on prominences, extensor surfaces, and surfaces exposed to irritation, than on protected surfaces, flexures and depressions. Most abundant and earliest on the face, next forearms and wrists and hands, favoring the limbs, especially distally, more than the trunk. More abundant on shoulders and chest than on loins or abdomen, but the lesions may be so few as to be overlooked. The individual lesions are deep seated and have an infiltrated base, except when modified naturally or by previous vaccination. Any case of purpura or hemorrhage into the skin with fever should be treated with smallpox precautions until another diagnosis is clear.
2. *Etiological agent:* A specific filtrable virus.
3. *Source of infection:* Lesions of the mucous membranes and skin of infected persons.
4. *Mode of transmission:* By contact with persons sick with the disease. This contact need not be intimate, but aerial transmission through more than a few feet is unlikely; by articles

or persons contaminated by discharges of the sick, including feces and urine, but for a brief time.

5. *Incubation period:* Eight to sixteen days. (Cases with incubation period of twenty-one days are reported.)
6. *Period of communicability:* From first symptoms to disappearance of all scabs and crusts.
7. *Susceptibility and immunity:* Susceptibility universal. Acquired permanent immunity usually follows recovery from an attack of the disease. Second attacks are rare. Artificial immunity by vaccination is usually complete for five to twenty years, but relative susceptibility often occurs after five years.
8. *Prevalence:* Distribution in sporadic or epidemic form; varies widely according to the immunity status of the population of an area and its exposure to infection from without. Cases occur most often in young adult males. Occurrence is most frequent in the winter and least in summer months. There is no regional or climatic limitation to its prevalence except as population groups are more or less well protected by vaccination.
9. *Methods of control:*

(*A*) The infected individual, contacts, and environment:

1. Recognition of the disease and reporting: Clinical symptoms. The rapidly fatal or fulminating type and the very mild type may escape diagnosis until secondary cases appear.
2. **Isolation: Hospital isolation in screened wards, free from vermin, until the period of infectivity is past.**
3. Concurrent disinfection of all discharges: No article to leave the surroundings of the patient without boiling or equally effective disinfection.
4. Terminal disinfection: Thorough cleaning and disinfection of premises.
5. Quarantine: Isolation of all contacts until vaccinated with virus of full potency, and daily medical observation of these contacts until height of reaction is passed, if vaccination was performed within twenty-four hours of first exposure; otherwise for sixteen days from last exposure.
6. **Immunization: Vaccination.**
7. Investigation of source of infection: The immediate prior case should be sought industriously, and cases of reported chickenpox associated in time or place carefully reviewed for error of diagnosis. Active cases of the disease without remaining constitutional symptoms must be sought, also passive carriers recently in contact with cases, and exposed vaccinated persons who may have developed unrecognized forms of the disease, and thus be serving as sources of infection.

(*B*) General measures:

1. **General vaccination in early infancy, revaccination of children on entering a school, and of entire population when the disease appears in a severe form.**
2. In order to avoid possible complications or secondary

and subsequent infections at the site of vaccination, it is important that the vaccination insertion be as small and superficial as practicable, not over $\frac{1}{8}$ inch in any direction, and that the site be kept dry and cool. The use of shields or other dressings is to be condemned. The multiple pressure method is recommended. Primary vaccination as soon after one week of age as possible is desirable. The time of vaccination should be adjusted to avoid skin lesions elsewhere on the body, and in older children to avoid the warmer months. Particular care should be used in primary vaccinations beyond the age of infancy.

SYPHILIS:

1. *Recognition of the disease:* A disease acquired by contact or transmission *in utero*, running a chronic course with local and constitutional manifestations, usually in a definite sequence although of infinite variety. The lesion is an infectious granuloma, similar to that seen in tuberculosis and leprosy, in the acquired disease usually on mucous or mucocutaneous area of sexual contact. Confirmation of diagnosis is practicable and should be established in every instance by finding the spirochete in the lesions or discharges or by positive serological findings.
2. *Etiological agent: Treponema pallidum*[1] (Fig. 170).

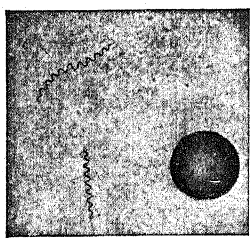


Fig. 170.—Spirochaeta pallida with a red corpuscle (× 1200). (Todd and Sanford.)

3. *Source of infection:* Discharges from the lesions of the skin and mucous membranes, the blood of infected persons, and articles freshly soiled with such discharges or blood in which the *Treponema pallidum* is present.
4. *Mode of transmission:* By direct personal contact with infected persons and indirectly by contact with discharges from lesions or with the blood of such persons, by sexual intercourse chiefly, by kissing, by dental and other surgical or technical accidents, congenitally from syphilitic mother through the placenta.
5. *Incubation period:* About three weeks, minimum ten days, occasionally six weeks or longer.

[1] Also called *Spirochaeta pallida.*

6. *Period of communicability:* As long as the lesions are open upon the mucous membranes or skin, but practically limited to the first two years of the disease.
7. *Susceptibility and immunity:* Susceptibility is universal, especially when moist surfaces of infected and exposed persons are brought into direct contact. Natural or acquired immunity is not known to exist. One attack and recovery does not protect against subsequent infection.
8. *Prevalence:* Widespread in all regions of the world, regardless of race, climate, or geography, or of sex or age. Prevalence varies from less than ½ of 1 per cent to 30 per cent and over of local population groups, averaging probably about 5 per cent of all the people of North America. Occurs in sporadic, local, or group epidemic, and commonly endemic form. Most commonly acquired by unmarried males between twenty and forty years of age. Occurs in about 10 per cent of all pregnant women. Most frequent among Negroes.
9. *Methods of control:*

(*A*) The infected individual, contacts, and environment:

1. Recognition of the disease and reporting: Clinical symptoms, confirmed by microscopical examination of discharges and by serum reactions. Diagnosis is essentially a laboratory problem and treatment should never be instituted without laboratory confirmation.
2. Isolation: Essential for noncooperative patients at least until surface lesions have healed. No person in the communicable stage of syphilis should be permitted to engage in occupations of personal service in which he or she may infect others with syphilis, such as those of nurse or nursemaid, domestic servant, barber, hairdresser, chiropodist, manicurist, bath attendant, masseur, wet-nurse. Sexual intercourse should be specifically warned against and so far as possible prevented for persons with syphilis until declared to be free from infection, by the physician responsible for treatment of the patient.
3. Concurrent disinfection of discharges and of articles soiled therewith.
4. Terminal disinfection: None.
5. Quarantine: None.
6. Immunization: None.
7. Investigation of source of infection: Each case, particularly those cases of presumably recent origin, as the congenital form of the disease in infants, and first- and second-stage cases of the acquired disease, should be traced to the probable source of infection, appropriate control and treatment of this spreader of disease instituted, and further exposed contacts examined for unsuspected or unreported cases.

(*B*) General measures:

1. **Provisions for accurate and early diagnosis and careful treatment of infected persons, with due considera-**

tion for privacy of record consistent with effective control of the patient, search for source of infection, and provision for following cases until cured.

2. Education in matters of sexual hygiene, particularly as to the fact that continence in both sexes and at all ages is compatible with health and normal development.
3. Repression of commercial prostitution and associated use of alcoholic beverages, by means of the police or other competent authority.
4. Restriction of advertising of services or medicines for self-treatment of sex diseases, etc.
5. Elimination of the use of common towels, cups, and toilet articles from public places.
6. Serological as well as clinical examination for syphilis should be part of the routine prenatal supervision of the expectant mother and if she is found to be infected, antisyphilitic treatment should be begun if possible before the end of the fifth month of pregnancy.
7. Personal prophylaxis should be advised and be made available for use immediately after sexual intercourse to those who expose themselves to infection.

TETANUS:

1. *Recognition of the disease:* An acute infectious disease caused by the toxin of the tetanus bacillus; characterized by painful muscular contractions, first and principally of the masseter and neck muscles, and secondly those of the trunk; rarely the rigidity

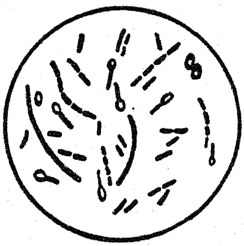


Fig. 171.—*Bacillus tetani.* The ones with rounded ends—drumstick appearance—are spore forms. (Lehmann and Neumann.)

is confined to the region of the injury. A history and usually physical evidence of a wound of entry for infection is found. Bacteriological examination and mouse inoculation may be useful in confirmation of diagnosis.

2. *Etiological agent:* Tetanus bacillus; *Clostridium tetani* (Fig. 171).
3. *Source of infection:* Animal manure, human feces, soil, and street dust.
4. *Mode of transmission:* Wound infection.
5. *Incubation period:* Commonly four days to three weeks, dependent somewhat upon the character, extent, and location of the wound.

Longer periods of incubation have been noted. Subsequent operative interference of local tissue changes may initiate the activity of quiescent bacilli at even lengthy intervals after the original wound infection.

6. *Period of communicability:* Patient not infectious except in rare instances where wound discharges are infectious.
7. *Susceptibility and immunity:* Susceptibility general, but inoculated bacilli often fail to produce toxin. Artificial passive immunity for about ten days' duration can be relied upon from the use of tetanus antitoxin. An active immunity may be produced by the use of tetanus toxoid.
8. *Prevalence:* World-wide distribution, following wound infection. Most frequent in North America among young males and in summer. Prevalent especially following wounds contaminated with manured soil.
9. *Methods of control:*

   (*A*) The infected individual, contacts, and environment:

   1. Recognition of the disease and reporting: Clinical symptoms may be confirmed bacteriologically.
   2. Isolation: None.
   3. Quarantine: None.
   4. Immunization: Ordinarily a subcutaneous injection of tetanus antitoxin (1500 units) given on the day of the wound. A second injection within ten days may be desirable in certain instances.
   5. Investigation of source of infection: Of only academic interest, as the infecting organism is widely spread, especially through animal feces, in all inhabited places.
   6. Concurrent disinfection: None.
   7. Terminal disinfection: None.

   (*B*) General measures:

   1. Educational propaganda such as "safety first" campaign, and "safe and sane Fourth of July" campaign.
   2. **Prophylactic use of tetanus antitoxin where wounds have been acquired in regions where tetanus is prevalent, and in all cases where contaminated material may be embedded in the wound.**
   3. **Removal of all foreign matter as early as possible from all wounds.**

TRICHINOSIS:

1. *Recognition of the disease:* In human beings confined to persons who have eaten raw or insufficiently cooked fresh pork products, occasionally bear meat, and characterized by onset of variable intensity according to the amount of infested meat eaten and the abundance of the trichinae in the meat. The symptoms of invasion may be mild or of severe gastro-intestinal disturbance. Muscle soreness or pain, edema of face and eyelids, weakness and distress are accompanied by a marked eosinophilia. Microscopic examination of the stools for adult worms, and of teased specimen of deltoid muscle for suspected embryos is helpful. Occasionally examination of the uncooked pork will reveal the parasites.

2. *Etiological agent: Trichinella spiralis* (Fig. 172).
3. *Source of infection.*—Uncooked or insufficiently cooked pork, rarely meat of other animals.
4. *Mode of transmission:* Direct from meat to man through consumption of undercooked infected pork products.
5. *Incubation period:* Variable; usually about one week.
6. *Period of communicability:* Disease is not transmitted by human host to man.
7. *Susceptibility and immunity:* Susceptibility is general. Neither natural nor acquired immunity is known to occur.

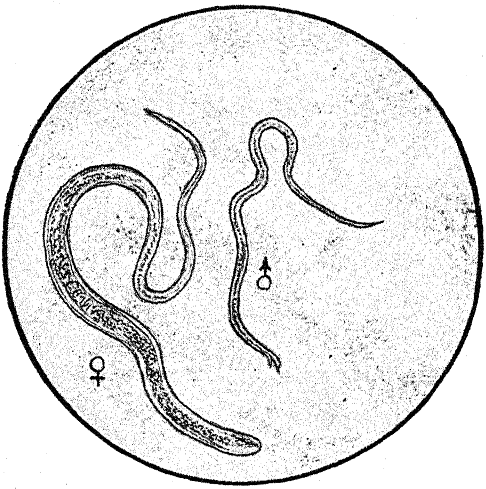


Fig. 172.—Adult *Trichinella spiralis* ♂, male, and ♀, female. From the duodenal contents of a white rat, ten days after infection, as seen under the low power of the microscope. (Rivas.)

8. *Prevalence:* World-wide, but uncommon. No selection by age, sex, race, region, season, or climate except as these affect the custom of eating the insufficiently cooked flesh of infested hogs or other animals.
9. *Methods of control:*
   (*A*) The infested individual, contacts, and environment:
   1. Recognition of the disease and reporting: Clinical symptoms, confirmed by microscopical examination of blood for eosinophilia, and about the third week for encysted larvae in muscle tissue.
   2. Isolation: None.
   3. Concurrent disinfection: Sanitary disposal of the feces of the patient.
   4. Terminal disinfection: None.
   5. Quarantine: None.

6. Immunization: None.
7. Investigation of source of infection: Every effort should be made to trace each case to a definite or profitable source of raw or undercooked pork. Where hogs are fed on, or have access to, human offal, and human beings eat insufficiently cooked fresh pork products, there is an endless sequence of infestation and reinfestation of hog and human.

(*B*) General measures:

1. Inspection of slaughtered hogs for the detection of trichinosis (rarely found unless muscles are heavily infested).
2. **Thorough cooking of all pork products at a temperature of 160° F. or over.**
3. **Refrigeration of pork at 5° F. for twenty days.**
4. Extermination of rats, especially around meat shops and slaughter houses and hog pens.
5. Cooking swill and offal which is to be fed to hogs.

TUBERCULOSIS, PULMONARY:

1. *Recognition of the disease:* Evidence of present or past infection in the absence of clinical symptoms can be determined by a variety of specific tuberculin reactions, among which the Mantoux intradermal test is the most reliable. In the presence of early constitutional symptoms with or without pulmonary signs, the existence or location of pulmonary or other thoracic lesions can best be revealed by the *x*-ray. When fever, cough, loss of appetite and weight, and physical signs on auscultation and percussion are found, the pulmonary lesion is already well developed. Discovery of tubercle bacilli in the sputum confirms the diagnosis not infrequently in early cases but is an evidence usually of a well-balanced lesion.[1]

[1] Tuberculosis in children: A distinction should be made between the childhood type and the adult type of tuberculosis because of medical and epidemiological differences. "The childhood type of tuberculosis is the name adopted to describe the diffuse or circumscribed lesions in the lungs and associated tracheobronchial lymph glands that result from a first infection of the pulmonary tissue with the tubercle bacillus" (Diagnostic Standards, National Tuberculosis Association). The chief difference between the childhood type and the adult type is that the former represents the reactions caused by the tubercle bacillus in unsensitized tissue while the latter is a reinfection of sensitized tissue. The childhood type is usually benign, but is of significance because it is often the precursor of the adult type of pulmonary tuberculosis.

From the medical standpoint, the childhood type of tuberculosis is of the greatest significance during the first three years of life, and from the ages of twelve to eighteen years. In school children it can be detected by routine application of the tuberculin test and *x*-rays of the positive reactors. School children with this type of tuberculosis do not usually need hospitalization if in good physical condition, living in a satisfactory home, and no longer exposed to a source of infection. They should have an annual roentgenogram of the chest for the remainder of their school life to detect further signs of advancing tuber-

2. *Etiological agent:* Tubercle bacillus (human), *Mycobacterium tuberculosis* (*hominis*). Tubercle bacilli of bovine type have been isolated from pulmonary lesions in man; avian type rarely (Fig. 173).
3. *Source of infection:* The specific micro-organism present in the discharges, or articles freshly soiled from the discharges, from any open tuberculous lesions, the most important discharge being sputum. Of less importance are discharges from the intestinal and genito-urinary tracts, or from lesions of the lymph nodes, bone, and skin.
4. *Mode of transmission:* Usually through the discharges of the respiratory tract, occasionally through those of the digestive tract, by direct or indirect contact with infected persons, by means of coughing, sneezing, or other droplet infections, by kissing, by

Fig. 173.—Tubercle bacilli in phthisical sputum. (Beck.)

the use of contaminated eating and drinking utensils, and possibly by contaminated flies and dust. Infection rarely occurs from casual contact, but usually results from the continued type of exposure characteristic of family relationships.
5. *Incubation period:* Variable and dependent upon the type of the disease.
6. *Period of communicability:* As long as the specific micro-organism is eliminated by the host. Commences when a lesion becomes an open one, *i. e.*, discharging tubercle bacilli, and continues until it heals or death occurs. The degree of communicability varies with the number and virulence of the bacilli discharged, the frequency of exposure, and the susceptibility of the persons exposed.

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culosis. If such routine examination of school children includes examination of family contacts of all cases of childhood type of tuberculosis it becomes an effective method for the discovery of the cases of pulmonary tuberculosis in adults who are unrecognized sources of infection.

7. *Susceptibility and immunity:* Susceptibility is general; in children greater than in adults; in aboriginal races more than among races long exposed to the disease; in the undernourished, fatigued, and neglected more than in the well fed and well cared for; in those exposed to dusty trades, and in particular to silica dust, more than in persons with outdoor occupations in clean air. Resistance of some degree is developed by age and by the maintenance of good nutrition.
8. *Prevalence:* Among the most common communicable diseases of man, with but slight variations of occurrence of infection, although considerable variation in mortality rate according to race. At present in some modern occidental nations its incidence as a disease has fallen markedly, and both incidence and deaths continue to fall from year to year. Infection occurs more commonly in childhood (from infancy to adolescence) than at later ages. Mortality highest among males between twenty-five and forty and among females about five years earlier. Aboriginal races when first exposed develop the disease in a rapidly fatal form.
9. *Methods of control:*
   (*A*) The infected individual, contacts, and environment:
   1. Recognition of the disease and reporting: By thorough physical examination supplemented by use of the *x*-ray and tuberculin testing when necessary and confirmed by bacteriological examination of sputum and other materials. Early discovery in contacts, particularly in family groups exposed to an open case of tuberculosis ("positive" sputum), is of great importance.
   2. Isolation of such "open" cases as do not observe the precautions necessary to prevent the spread of the disease may prove advisable. A period of hospital or sanatorium treatment is very desirable in all cases to remove the patient as a focus of infection in his home, and to teach him the hygienic essentials of tuberculosis control as well as to increase his chances of recovery.[1]
   3. Concurrent disinfection: Of sputum and articles soiled with it. Particular attention should be paid to prompt disposal or disinfection of sputum itself, of handkerchiefs, cloths, or paper soiled therewith, and of eating utensils used by the patient.
   4. Terminal disinfection: Cleaning and renovation.
   5. Quarantine: None.
   6. Immunization: None.
   7. Investigation of source of infection: In spite of the length and uncertainty of the incubation period and the numerous possible sources of infection, a systematic effort should be made to discover the probable source in each case and to identify other cases

[1] "Collapse therapy" is often of value in appropriate cases of the disease in shortening the period of communicability, as well as in reducing the case fatality.

of the same origin, by thorough examination by x-ray, physical examination, and where appropriate by tuberculin test of family and household contacts.

(*B*) General measures.

1. Education of the public in regard to the danger of tuberculosis, the mode of spread and the methods of control, with especial stress upon the danger of exposure and infection in early childhood.
2. Provision of dispensaries and visiting-nurse service for discovery of early cases and supervision of home cases.
3. **Provision of adequate sanatorium facilities for isolation and treatment of active cases. Two beds per annual tuberculosis death in the community is an adequate ratio.**
4. Provision of open-air schools and preventoria for infected children not yet showing clinical signs of the disease.
5. Improvement of housing conditions and nutrition of the poor.
6. Elimination of silica dust in certain industrial establishments.
7. Improvement of habits of personal hygiene and betterment of living conditions among the underprivileged.
8. Separation of babies from tuberculous mothers at birth.
9. Pasteurization of all milk supplies.
10. Eradication of tuberculosis in cattle.
11. Where the disease is endemic and the incidence high particularly among little children, the routine use of B. C. G. vaccine in infancy for active immunization has been suggested.

TUBERCULOSIS, OTHER THAN PULMONARY:

1. *Recognition of the disease:* By local manifestations, by constitutional reactions, by specific reactions, and by microscopic identification of the tubercle bacillus in the lesions or their discharges.
2. *Etiological agent:* Tubercle bacillus (human and bovine), *Mycobacterium tuberculosis* (*hominis et bovis*).
3. *Source of infection:* Discharges from mouth, nose, bowels, and genito-urinary tract of infected human beings; the discharging lesion of bones, joints, and lymph glands; articles freshly soiled with such discharges; milk from tuberculous cattle.
4. *Mode of transmission:* By direct contact with infected persons, by contaminated food, and possibly by contact with articles freshly soiled with the discharges of infected persons.
5. *Incubation period:* Unknown.
6. *Period of communicability:* Until discharging lesions are healed.
7. *Susceptibility and immunity:* (See statement under this heading in Pulmonary Tuberculosis.)
8. *Prevalence:* Much less common than the pulmonary form and

more rapidly falling in incidence, representing about 10 per cent of total cases and deaths from the disease. Especially common in infants and young children where intimately exposed to parent infection and to bovine infection through unpasteurized milk from tuberculous cattle.

9. *Methods of control:*
   (*A*) The infected individual, contacts, and environment:
   1. Recognition of the disease and reporting: Clinical signs and symptoms confirmed by bacteriological and serological examinations.
   2. Isolation: None.
   3. Concurrent disinfection: Discharges and articles freshly soiled with them.
   4. Terminal disinfection: Cleaning.
   5. Quarantine: None.
   6. Immunization: None.
   7. Investigation of source of infection: Search should be made for possible original source in family, household, or other intimate contacts, and to discover previously unrecognized cases of similar origin, such a search to be aimed at discovery of infected but latent or arrested cases as well as those showing an active process. Special inquiry and investigation should be made to discover possible source of bovine tubercle infection where unpasteurized milk has been used in the family or particularly used uncooked, by the patient.

   (*B*) General measures:
   1. **Pasteurization of milk and milk products and inspection of meats.**
   2. **Eradication of tuberculosis in dairy cattle.**
   3. Patients with open lesions should be prohibited from handling foods.
   4. **Adequate hospital, sanatorium, preventorium, and out-patient facilities for discovery, control and clinical management.**

TYPHOID FEVER:

1. *Recognition of the disease:* A general infection with the typhoid bacillus, characterized by a continued fever, and by involvement of the lymphoid tissues especially with enlargement and often ulceration of Peyer's patches, enlargement of the spleen, usually rose spots on the trunk, diarrheal disturbance, and a variety of severe constitutional disturbances accompanying parenchymatous involvement of various viscera. The infecting micro-organism can be found in the blood, the feces, and the urine.
2. *Etiological agent:* Typhoid bacillus, *Eberthella typhi* (Fig. 174).
3. *Source of infection:* Bowel discharges and urine of infected individuals. Healthy carriers are common.
4. *Mode of transmission:* Conveyance of the specific micro-organism by direct or indirect contact with a source of infection. Among indirect means of transmission are contaminated water, milk, and shellfish, and probably flies.

5. *Incubation period:* From three to thirty-eight days, usually seven to fourteen days.
6. *Period of communicability:* From the appearance of prodromal symptoms, throughout the illness and relapses during convalescence, and until repeated bacteriological examinations of the discharges show continuous absence of the infecting organism.
7. *Susceptibility and immunity:* Susceptibility is general. Natural immunity exists to some extent in adults. Acquired immunity of permanent duration usually follows recovery from the disease. Artificial active immunity of probably two years' duration can be developed by the use of typhoid vaccine.
8. *Prevalence:* Widespread throughout the world regardless of race, age, sex, climate, or geography. Formerly in most large cities of North America and in many extensive rural areas in endemic and epidemic form, and still endemic in some rural areas of the southern United States but commonly now occurring in sporadic cases and as small contact and carrier epidemics. Steadily

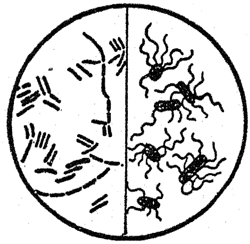

Fig. 174.—*Bacillus typhosus.* Some show flagella which give them motile power. (Lehmann and Neumann.)

falling in incidence, particularly in all urban areas supplied with water of a sanitary quality and pasteurized milk, and where human fecal waste is disposed of without polluting water supplies, food, or surface of the soil.
9. *Methods of control:*
   (*A*) The infected individual, contacts, and environment:
      1. Recognition of the disease and reporting: Clinical symptoms confirmed by specific agglutination test and bacteriological examination of blood, bowel discharges, or urine.
      2. Isolation: In fly-proof room, preferably under hospital conditions, of such cases as cannot command adequate sanitary environment and nursing care in their homes. Release from isolation should be determined by two successive negative cultures of stool and urine specimens collected not less than twenty-four hours apart.
      3. **Concurrent disinfection: Disinfection of all bowel and urinary discharges and articles soiled with them.**

4. Terminal disinfection: Cleaning.
5. Quarantine: None.
6. Immunization: Of susceptibles in the family or household of the patient who have been exposed or may be exposed during the course of the disease.
7. Investigation of source of infection: The actual or probable source of infection of every case should be determined by searching for common and individual sources: (1) polluted water, milk, shellfish, and other food supplies, (2) unreported cases and carriers.

(*B*) General measures:

1. **Protection of purification of public water supplies.**
2. **Pasteurization of public milk supplies.**
3. Limitation of collection and marketing of shellfish to those from approved sources.
4. **Sanitary disposal of human excreta.**
5. Supervision of other food supplies, and of food handlers.
6. Prevention of fly breeding.
7. Extension of immunization by vaccination to persons subject to unusual exposure by reason of occupation or travel, to those living in areas of high endemic incidence of typhoid fever and to those for whom the procedure can be systematically and economically applied, as in the military forces and institutional populations.
8. Discovery and supervision of such typhoid carriers, and their exclusion from the handling of foods, as epidemiological and bacteriological evidence indicate are of importance.
9. Exclusion of suspected milk supplies on epidemiological evidence pending discovery and elimination of the cause of contamination of the milk.
10. Exclusion of suspected water supply, until adequate protection or purification is provided unless all water used for toilet, cooking, and drinking purposes is boiled before use.
11. Education of the general public and particularly of food handlers, concerning the sources of infection, and modes of transmission of the disease.
12. Instruction of convalescents and chronic carriers in personal hygiene, particularly as to sanitary disposal of fecal waste, and handwashing after use of toilet, and restraint from acting as food handlers.

WHOOPING COUGH (PERTUSSIS):

1. *Recognition of the disease:* An acute infection involving trachea and bronchi and characterized by an initial catarrhal stage with slight fever, and a paroxysmal stage in which the paroxysmal cough ends in a sonorous or whooping inspiration often accompanied by vomiting. Identification of the Bordet-Gengou bacillus in the tenacious tracheobronchial mucus can be made

in a high percentage of cases during the early and paroxysmal stages of the disease before the whoop develops, and less readily from the fourth to the sixth week after the onset of the disease by the use of special cough culture plates held before the mouth during a spontaneous or induced paroxysm of coughing. A definite lymphocytosis in the preparoxysmal stage may assist the clinical diagnosis.

2. *Etiological agent:* Pertussis bacillus of Bordet and Gengou, *Haemophilus pertussis* (Fig. 175).
3. *Source of infection:* Discharges from the laryngeal and bronchial mucous membranes of infected persons.
4. *Mode of transmission:* Contact with an infected person, or with articles freshly soiled with the discharges of such person.
5. *Incubation period:* Commonly seven days, almost uniformly within ten days, and not exceeding sixteen days.
6. *Period of communicability:* Particularly communicable in the early catarrhal stage before the characteristic whoop makes a clinical diagnosis possible. The catarrhal stage occupies from seven to

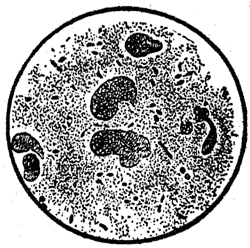

Fig. 175.—*Bacillus pertussis*, also known as the Bacillus Bordet-Gengou. (Lehmann and Neumann.)

fourteen days. After the characteristic whoop has appeared, the communicable period continues certainly for three weeks. Even if the spasmodic cough with whoop persists longer than this it is most unlikely that the infecting organism can be isolated from the discharges. The communicable stage must be considered to extend from seven days after exposure to an infected individual to three weeks after the development of the characteristic whoop.

7. *Susceptibility and immunity:* Susceptibility is general. There is no natural immunity. The greatest susceptibility is in children between six months and five years of age, after which there is some decrease. One attack confers a definite and prolonged immunity, although second attacks do occur. A brief passive immunity may be conveyed to young children by convalescent serum or adult whole blood. Artificial immunity is still of doubtful value and as yet of no definite reliance. Susceptibility is apparently higher in females at all ages than in males.
8. *Prevalence:* Very prevalent, and a common disease among children everywhere regardless of race, climate, or geographical location.

About half the reported cases in cities are in children under five years of age, and 90 per cent in children under ten. Incidence and fatality rates are higher among females. Somewhat less prevalent in tropical than in temperate climates. Seasonal incidence variable, but mortality higher usually in spring months in North America. Cyclical occurrence irregular.

9. *Methods of control:*

(*A*) The infected individual, contacts, and environment:

1. Recognition of the disease and reporting: Clinical symptoms, supported by a differential leukocyte count, and confirmed where possible by bacteriological examination of bronchial secretions. A positive diagnosis may be made by bacteriological examination of laryngeal discharges as early as one week before the development of the characteristic cough.
2. Isolation: Separation of the patient from susceptible children, and exclusion of the patient from school and public places for the period of assumed infectivity. It is of particular importance to protect children under three years of age against contact with any other children with cough and fever, of whatever origin, and especially if whooping cough is suspected or is known to be prevalent. Isolation of children over two years of age is impracticable, and even in those under two should not be insisted upon at the expense of fresh air in the open if weather permits.
3. Concurrent disinfection: Discharges from the nose and throat of the patient and articles soiled with such discharges.
4. Terminal disinfection: Cleaning of the premises used by the patient.
5. Quarantine: Limited to the exclusion of nonimmune children from school and public gatherings for ten days after their last exposure to a recognized case. This precaution may be omitted if exposed nonimmune children are observed with care by a physician or nurse on their arrival at school each day for ten days after their last exposure to a recognized case.
6. Immunization: Use of prophylactic vaccination is recommended by some observers, but is still considered to be of doubtful reliability.
7. Investigation of source of infection: An effort should be made to discover undiagnosed and unreported cases, with the main object in view of protecting young children from exposure, and thus reducing the mortality. Postponement of the age of infection at least until school age and great care in the management of the disease in young children offer some hope of reducing deaths from whooping cough although reduction of incidence by any means appears

unlikely. Carriers in the exact sense of this term are not known to occur.

(*B*) General measures: Education in habits of personal cleanliness and in the dangers of association or contact with those showing catarrhal symptoms with cough.

COMMON COLD:

1. *Recognition of the disease:* An acute catarrhal affection of the upper respiratory tract, usually accompanied by a slight rise of temperature on the first day and chilly sensations with coryza, and general indisposition or lassitude lasting two to seven days.
2. *Etiological agent:* A filtrable virus.
3. *Source of infection:* Discharges from nose and mouth of infected persons.
4. *Mode of transmission:* Usually directly by coughing, sneezing, and explosive manner of speech by which droplets are cast out into the air from the infected person to be inhaled by, or impinged on the face of, susceptible persons within short range of 3 feet or so; also by hand to face transfer of discharges, and indirectly by handkerchiefs, eating utensils, or other articles freshly soiled by discharges of the infected person.
5. *Incubation period:* Probably between twelve and forty-eight hours; possibly as long as seventy-two hours.
6. *Period of communicability:* While the virus remains in the discharges, an undetermined period, but believed to be limited to the early stages of the disease and probably no longer than a week from the onset.
7. *Susceptibility and immunity:* Susceptibility universal. A period of at least relative immunity follows an attack of the disease and appears to be effective for a month or so.
8. *Prevalence:* Most persons, except those living in small isolated communities, have one or more colds each year. The incidence does not vary materially according to age, sex, race, or occupation, but incidence appears to be highest in children under five years of age.
9. *Methods of control:*

   (*A*) The infected individual, contacts, and environment:

   1. On recognition of the premonitory or early stage of a "cold" the infected person should avoid direct and indirect exposure of others, particularly little children, feeble or aged persons, or persons suffering from any other illness.
   2. Isolation: Such modified isolation as can be accomplished by rest in bed for one or two days is to be advised.
   3. Concurrent disinfection: The disposal of nasal and mouth discharges by the use of soft paper, by burning or putting in the toilet, or otherwise, to avoid contamination of hands and articles of common use, is to be urged.
   4. Terminal disinfection: None, except airing and sunning room and bedding.
   5. Quarantine: None.

6. Immunization: None.
7. Investigation of source of infection: Unprofitable except as a research project.

(*B*) General measures:

1. Education in the refinements of personal hygiene and disposal of nose and mouth secretions.
2. Maintenance of good bodily resistance by regular use of fresh air by day and by night, outdoor exercise, sufficient rest to avoid conscious fatigue, a balanced diet, regular bowel evacuation, and clothing appropriate to climate and use.

RINGWORM (OF SCALP, BODY, FEET, AND GROIN):

1. *Recognition of the disease:* Inspection of the scalp and other parts of the body for the characteristics of the local lesion. Identification of the fungus in the scrapings from the edges of the skin areas involved.
2. *Etiological agent:* Trichophyton, or epidermophyton.
3. *Source of infection:* Lesions on bodies of infected persons or articles of clothing carrying the fungus or its spores.
4. *Mode of transmission:* Direct skin-to-skin contact with lesions of infected persons and indirectly by articles of wearing apparel or by surfaces contaminated by scurf or scalings or hair from lesions.
5. *Incubation period:* Undetermined.
6. *Period of communicability:* As long as the fungus or its spores can be found at the site of the lesions. Transmission is easy in ordinary conduct of home or recreational pursuits, particularly those carried out indoors.
7. *Susceptibility and immunity:* Susceptibility is general. There is relative immunity to scalp ringworm after fifteen years of age.
8. *Prevalence:* Widespread, varying with aggregation of people under conditions appropriate for spread, as at swimming pools. Foot ringworm more common in adults, and the body, face, and head form more so among children, more especially in warm weather.
9. *Methods of control:*

(*A*) The infected individual, contacts, and environment:

1. Recognition of disease and reporting: All cases recognized on inspection of school children should be reported to school authorities.
2. Isolation: Children and adults with marked cases of the disease should be excluded from privileges in gymnasium and at swimming pools. Exclusion from school may be desirable in cases of ringworm of the scalp. There are too many carriers of foot ringworm to make control of them at all practicable.
3. Concurrent disinfection: Cleanliness of body and underclothing, especially socks.
4. Terminal disinfection: None.
5. Quarantine: None.
6. Immunization: None.
7. Investigation of source of infection: Among school children medical inspection should be used to detect

unreported cases. In gymnasia and buildings devoted to athletics, particularly swimming, search should be made as a routine, to exclude cases from common facilities.

(*B*) General measures:

1. Cleanliness of body and underclothing.
2. Prompt and persistent treatment of the lesions should be urged.
3. Protection of feet against contamination in showers and dressing rooms and areas used by people with bare feet.
4. The use of disinfecting solutions may prove useful in connection with common bathing and dressing rooms.

APPENDIX B

SUGGESTED LIST OF TOPICS FOR A TERM REPORT[1]

1. Standards of health at different periods of the world's history.
2. Justification of the phrase, "To live most and to serve best." (Several approaches may be made to this topic.)
3. Popular notions of vitality. (Advertisements in newspapers evaluated.)
4. The health work of a national organization (select one, such as the Red Cross, The National Tuberculosis Association).
5. Comparison of the concept of health that you have with that held by persons in India (or any foreign country).
6. A critical essay on, What is of most worth?
7. The facts of heredity bearing on individual health.
8. The facts of environment bearing on national health.
9. Social legislation in your state bearing on health.
10. Legislation in the United States directed at race improvement.
11. Longevity.
12. The use of instinct as a health guide.
13. The economic, social, and health factors in suicide.
14. Health and vocational success.
15. Energy: how it is secured and conserved.
16. The meaning of the long period of infancy and its bearing on health.
17. Superstitions concerning health.
18. Analysis of a recent instance (newspaper item) of superstition in relation to scientific data on health.
19. Cults that deal with health.
20. Antivivisection: health implications.
21. Antivaccination: health implications.
22. Typhoid inoculation in armies.
23. The intellectual respectability of muscular skill.
24. Meaning of organismic unity in education.
25. Relations between exercise and health.
26. What is physical fitness? How determined?
27. Hiking clubs: health implications of hiking.
28. Significance of minerals in food.
29. The story of vitamin discovery.
30. Vegetarianism.
31. Air and health.
32. Health hazards of an occupation.
33. Health hazards in your own community.
34. Shoes and health.

[1] Topics are suggested that may be investigated by the student with limited library facilities. Some require extensive reading to treat adequately the topic.

35. The physical and psychical elements in postures.
36. Developing resistance to disease.
37. How to form health habits.
38. The prevention of worry.
39. Wholesome mental attitudes.
40. Cancer: What is known about it?
41. Tuberculosis: its cause, prevention, and cure.
42. Sleeping sickness: myth or reality.
43. Old age and rejuvenation.
44. Economics and sickness.
45. Health insurance.
46. The increase in nervous and mental diseases.
47. Venereal diseases, causes, and prevention.
48. How to use the muscles.
49. The tonsils and disease.
50. Smoking and health.
51. Alcohol: facts relating to health.
52. Prevention of colds.
53. The home medicine chest: what it should contain and how to use home medication.
54. Swimming, pools, and health.
55. The health services of a state Board of Health.
56. Systems of body building.
57. The social, ethical, and esthetic meanings of sex.
58. The revelations of the Selective Service Draft.
59. Accidents and their prevention.
60. How to strengthen the heart.

APPENDIX C

The following true-false test is based mainly upon the Preface and first five chapters. It is included here as an example of this kind of test. This form has been used by the author for twenty years and is standardized for college graduate students.

Name.......................... Seat Number................

The letters T and F precede each statement below. Encircle the letter T if the statement is true. Encircle the letter F if the statement, or any part of the statement, is false. *Do Not Guess.* If you are unable to decide whether a statement is true or false, leave it alone. You will be penalized for each statement marked incorrectly by having one point or credit deducted from the number of statements marked correctly.

T F 1. Hygiene should not be regarded as an academic subject; its primary purpose is to affect living.

T F 2. Ridding one's self of biases and outmoded conceptions of health is prerequisite to the functioning of hygiene in human lives.

T F 3. The degree to which an individual lives at his best is closely paralleled by his knowledge of hygienic procedures.

T F 4. The essential unity of life is the first argument for the functional importance of physical vigor.

T F 5. The dividing line between health and lack of health can be scientifically and precisely drawn.

T F 6. Health is a dynamic value, well defined by the term "freedom from disease."

T F 7. The gulf between knowledge and practice in matters of hygiene is becoming increasingly negligible.

T F 8. There are life occasions of so fundamental a social significance that health may be justifiably sacrificed to them.

T F 9. Changes in human protoplasm lack reliability because in the human realm, scientific laws governing change are inoperative.

T F 10. There are some aspects of community health which cannot be controlled by organizations.

T F 11. The concept of rewards and punishments bestowed by the social group introduces fear as a controlling factor of conduct.

T F 12. At times, the social and physical environments are more significant than the biological heritage of an individual.

T F 13. Health facts must be associated with human drives and biases if they are to affect the quality of living.

T F 14. War is the period of greatest loss of life in a nation.

T F 15. Problems like the sterilization of the unfit are to be solved exclusively through legislative channels.

T F 16. When health is defined as a condition of living at one's highest level, the question of individual differences is eliminated.

T F 17. Everything which one does reacts upon the organism and affects its function.

T F 18. The best guarantee of truly fine living for the individual is fortunate material circumstances surrounding that individual.

T F 19. The chief obstacles to a sound conception of health arise in the common human traits of credulity, physical inertia, and absence of reflective thinking.

T F 20. Real self-development or self-achievement is only accomplished by interest in something outside of self.

T F 21. It is known that germ plasm may contain traces of a disease like tuberculosis.

T F 22. Both the system of control by rewards and punishments and the system of control by ideals are related to the support and preservation of group values.

T F 23. The problem in conserving national health arises from the fact that almost no deaths and relatively little illness are preventable.

T F 24. Studies in social service by reliable agencies illustrate that environment does not markedly affect health.

T F 25. The phrase "living most and serving best" is primarily ethical in its implications.

T F 26. The standard of rewards and punishments as the criterion of conduct is a development of the pain-pleasure standard.

T F 27. "Health for health's sake" is a doctrine based upon a misconception of the function of health; health is only significant in terms of social outcomes.

T F 28. The organism will, if it survives and passes through a normal life cycle, realize its hereditary capacities to the fullest extent.

T F 29. The function of ideals is the modification of conduct.

T F 30. Any loss to national health resources which cannot be tabulated may be discounted as of minor significance.

T F 31. Informational education in health procedures is made effective only through habituation, attitudes, and ideals.

T F 32. The salutary effect of education upon superstitions was illustrated by Coué's failure to number school teachers as a group among his followers.

T F 33. Intellect must cut itself off and destroy instinct if it is to be effective in determining such values as fine living.

T F 34. Ideals are essentially quantitative; the more one possesses, the surer one is of achieving a high level of conduct.

T F 35. The essence of all magic is the belief that results can be accomplished without the intelligent control of means.

T F 36. A true ideal of social responsibility takes account of the present but does not try to encompass an unknown future.

T F 37. Intelligence should have the dominant place in one's decisions.

T F 38. There may be just as much danger to health in self-expression as in self-repression.

T F 39. Health habits are dependent upon the law of neurone action expressed by the principle of S-R bonds.

T F 40. That which, in the truest sense, best serves the individual is likely to be in conflict with that which best serves the race.

T F 41. One distinction between man and the lower animals is man's conscious willingness to sacrifice himself for others.

T F 42. Potentialities for stages of development through which we, as infants, are to pass, are well reflected in our emotional and social lives.

T F 43. Sterilization of every feebleminded individual would automatically wipe out the hereditary defect of feeblemindedness.

T F 44. An ideal of social responsibility is an adult characteristic to be introduced into the higher levels of education.

T F 45. Instincts must be allowed outlets of expression but the degree and kind of such expression must be determined by its results in human life.

T F 46. The possession of an hereditary defect is *per se* tremendously significant from a eugenic point of view.

T F 47. Ignorance or the lack of scientific understanding of the nature of the human organism results in the substitution of superstitution for fact.

T F 48. Fatigue is an abnormal phenomenon, and should be precluded by one's mode of living.

T F 49. Energy levels are determined partially by the food consumed.

T F 50. The activity of the nervous and endocrine systems is considered at the present time the key to energy release.

T F 51. The development of specialization in one group of cells affected the function of other cell groups.

T F 52. In the scale of development of life forms, a significant amount of muscle tissue first appears in the flat worms.

T F 53. The jellyfish has little or no nervous system and no respiratory system.

T F 54. The fundamental muscles of the trunk are more central but biologically no older than the peripheral muscles.

T F 55. The interdependence of organic systems in man is the basis for the maintenance of health balance.

T F 56. The fundamental muscle centers, according to Tyler are the seats of endurance.

T F 57. Science, following its well-defined method, cannot be wrong in its results.

T F 58. A science is distinguished from a cult in that the former is interested in ascertaining the truth while the latter is interested in promulgating a point of view.

T F 59. Real functional diseases have never been cured by cults.

T F 60. The essential doctrines of healing cults contain some truth.

T F 61. Intelligent persons should not depend upon cults to guide them in solving problems.

T F 62. Most of the modern problems of hygiene are as old as the human race.

T F 63. The body is primarily an organism with ability to receive, store, and express energy.

T F 64. The brain is a specialized organ which developed independently of other bodily systems.

T F 65. Man in his most complex and civilized state has still a basis for action which he holds in common with an organism as simple as the ameba.

T F 66. A nerve impulse, since it connects the action of a distant nerve cell with the response of a muscle in vigorous contraction, is an interacting agent.

T F 67. Ideals and science are a combination which promise the most for human welfare.

T F 68. The development of the brain resulted in the throwing out of nerve fibers and the consequent development of the nervous system.

T F 69. The chemistry of life processes in man and the character of his ideals are directly connected through the channels of nervous control.

T F 70. One test of an educated person is the power to discriminate between those forms of therapy that are wholly without scientific justification and those that have rational bases.

T F 71. In man all parts and organs develop biologically at the same rate.

T F 72. Interaction is increasingly being recognized as a correlative of action and reaction within the body.

T F 73. Man's nervous system differs from that of lower organisms in that he can use his will to control all his life processes.

T F 74. It is educationally desirable to secure all health habits upon a level of automaticity of action.

T F 75. The scientific method carefully protects its findings from uninvited inspection.

T F 76. Science resembles ascetism in its belief that by punishing the flesh, the spirit is benefited.

T F 77. There is no harm to the world at large in allowing cults to practice their false cures on mild diseases which nature will cure in any case.

T F 78. Scientific discovery is, in itself, no guaranty of improved life conditions.

T F 79. The philosopher, Berkeley, supported the view that every idea must have a physical counterpart to embody it.

T F 80. Magic arose as an explanation of the unknown.

T F 81. Magic is a technic of evasion and appeasement.

T F 82. Science, to further its ends, is frequently required to be inhumane.

T F 83. The characteristic appeal of patent medicines is to fear.

T F 84. The principle of scientific explanation is that of being true to discoverable conditions.

T F 85. The application of modern hygiene to problems of public health began in the latter part of the nineteenth century.

T F 86. The cyclic currents through nerves are broken by mechanical interference from the malposition of vertebrae.

T F 87. In those historical periods in which the spiritual has been man's chief concern, the greatest strides in the improvement of human welfare have been made.

T F 88. Generalization from a single atypical instance is a common basis for superstition.

T F 89. All patent medicines are injurious.

T F 90. Fear, which taught the savage to devise charms against danger, still operates to the same end where ignorance supports it.

T F 91. Exposing the individual to scientific truth is a sure cure for misinformation.

T F 92. Headache remedies containing acetanilid are harmless but fail to remove the real cause of the headache.

T F 93. The function of the average mouth wash is primarily mechanical rather than chemical.

T F 94. That excessive acidity is responsible for the development of the common cold is without any scientific substantiation.

T F 95. In the hands of a competent physician, drugs are invaluable for the purposes of stimulation, depression, or to supply deficient substances in the body.

T F 96. Nature sets the potential limits of human response; environment affords the possible choices; and education directs the responses actually made within these boundaries.

T F 97. In this so-called "scientific age," men are loath to subject their private beliefs to scientific analysis.

T F 98. The nerves running from the spinal cord into the head are those manipulated by the chiropractor in treating sinus infection.

T F 99. When disease is due to organic defects, no salutary effects can be produced through mental attitudes.

T F 100. The powers exerted by the Pure Food and Drugs Act outweigh its limitations in protecting the public from the unscrupulous vendors of patent preparations.

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